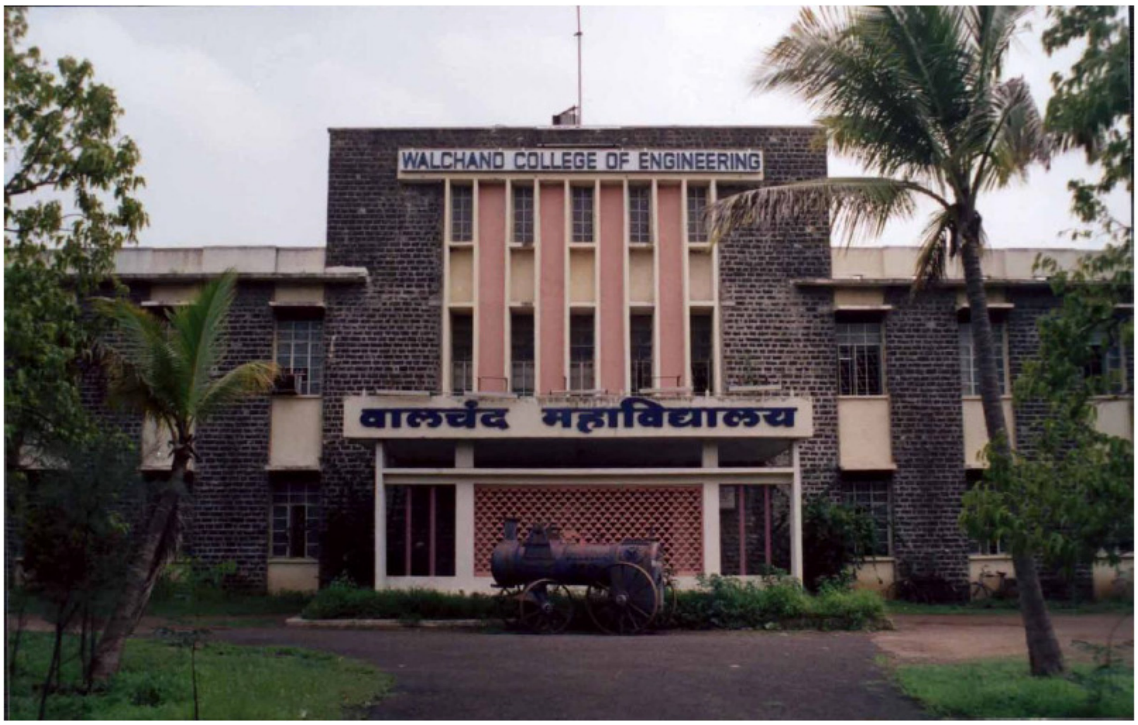
# Academic Documents for

# FY B. Tech. (Computer Science and Engineering)




# Walchand College of Engineering, Sangli

(An Autonomous Institute)

# Contents

# Vision Mission and Objectives of Institute

**Vision:**

1. To produce capable graduate engineers with an aptitude for research and leadership

**Mission:**

1. To impart quality education through demanding academic programmes.
2. To enhance career opportunities for students through exposure to industry.
3. To promote excellence by encouraging creativity, critical thinking and discipline.
4. To inculcate sensitivity toward society and a respect for the environment.

**Objectives:**

1. Achieve excellence in learning and research through continual improvement in both content and delivery of the academic programmes.
2. Promote close interaction among industry, faculty and students to enrich the learning process and enhance career opportunities for students.
3. Develop state - of - the - art laboratories and other infrastructure commensurate with the need of delivering quality education and research services.
4. Strngthen the Institution through network of alumni and optimize use of resources by leveraging inter - departmental capabilities.
5. Provide opportunities and ensure regular skill. Up - gradation of faculty and staff through structured training programmes.

# Vision, Mission, and Programme Educational Objectives of Department

| **Vision:** |
|---|
| To produce capable computer science & engineering graduates with an aptitude for research and leadership |
| **Mission:** |
| To promote excellence in CSE education through relevant academic curricula and innovative teaching learning processes |
| To offer different opportunities to the students for development of professional skills |
| To nurture critical thinking and creativity in the students |
| To inculcate in the students life-long learning attitude and sensitivity towards society & environment |

| **Program Educational Objectives (PEOs)** | |
|---|---|
| PEO1 | Demonstrate technical competency by applying knowledge to solve problems related to engineering issues. |
| PEO2 | Exhibit skills and right attitude to succeed in their professional career |
| PEO3 | Display thirst for emerging technologies and quest for innovation with concern to society and environment. |

# Programme Outcomes

## Engineering Graduates will be able to:

1. **Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

2. **Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

3. **Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

4. **Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

5. **Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

6. **The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

7. **Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

8. **Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

9. **Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

10. **Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

11. **Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one’s own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

12. **Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

# Programme Specific Outcomes (PSOs)

| | |
|---|---|
| **Computer Science and Engineering** | **PSO1**: Apply knowledge in relevant domains of computer science and engineering to solve real life problems.<br><br>**PSO2**: Adapt to modern computing technologies for industry readiness, higher studies and entrepreneurship. |

# Walchand College of Engineering, Sangli

(An Autonomous Institute)

# Draft Curriculum (Structure)

# for

# B.Tech. in Computer Science and Engineering

# Academic Year

# FY B. Tech. 2018-2019

# SY B. Tech. 2019-2020

# TY B. Tech. 2020-2021

# Final Year B. Tech. 2021-22

**Walchand College of Engineering, Sangli**
(An Autonomous Institute)
Teaching and Evaluation Scheme effective from 2018-19
**First year B. Tech. Program in Computer Science and Engineering**
Semester I

| Course | | | Teaching Scheme | | | | Evaluation Scheme | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Category | Code | Name | L | T | P | Credits | Component | Marks: Max | Marks: Min for Passing | |
| BS | 4CH103 | Chemistry for Computer Professionals | 3 | - | - | 3 | ISE 1 | 10 | | 40 |
| | | | | | | | MSE | 30 | | |
| | | | | | | | ISE 2 | 10 | | |
| | | | | | | | ESE | 50 | 20 | |
| BS | 4MA101 | Engineering Mathematics I | 3 | 1 | - | 4 | ISE 1 | 10 | | 40 |
| | | | | | | | MSE | 30 | | |
| | | | | | | | ISE 2 | 10 | | |
| | | | | | | | ESE | 50 | 20 | |
| ES | 4AM102 | Introduction to Engineering Mechanics | 2 | - | - | 2 | ISE 1 | 10 | | 40 |
| | | | | | | | MSE | 30 | | |
| | | | | | | | ISE 2 | 10 | | |
| | | | | | | | ESE | 50 | 20 | |
| ES | 4CV101 | Basic Civil Engineering | 2 | - | - | 2 | ISE 1 | 10 | | 40 |
| | | | | | | | MSE | 30 | | |
| | | | | | | | ISE 2 | 10 | | |
| | | | | | | | ESE | 50 | 20 | |
| ES | 4ME102 | Engineering Graphics | 1 | - | 4 | 3 | ISE | 100 | | 40 |
| BS | 4BS10* | Elective on Basic Sciences | 2 | - | - | 2 | ISE 1 | 10 | | 40 |
| | | | | | | | MSE | 30 | | |
| | | | | | | | ISE 2 | 10 | | |
| | | | | | | | ESE | 50 | 20 | |
| BS | 4CH151 | Engineering Chemistry Laboratory | - | - | 2 | 1 | ISE | 100 | 40 | |
| ES | 4CV151 | Civil and Mechanics Laboratory | - | - | 2 | 1 | ISE | 100 | 40 | |
| ES | 4ME152 | Workshop Practice | - | - | 2 | 1 | | | | |
| Total | | | **13** | **1** | **10** | **19** | **Total Credits: 19**<br>**Total Contact Hrs: 24** | | | |

| Elective on Basic Sciences | | | |
|---|---|---|---|
| 4BS101 | Biology for Engineers | 4BS102 | Material Science |
| 4BS103 | Introduction to Geoscience | 4BS104 | Life Science |

**Walchand College of Engineering, Sangli**
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Teaching and Evaluation Scheme effective from 2018-19
**First year B. Tech. Program in Computer Science and Engineering**
Semester II

| Course | | | Teaching Scheme | | | | Evaluation Scheme | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Category | Code | Name | L | T | P | Credits | Component | Marks | | |
| | | | | | | | | Max | Min for Passing | |
| BS | 4PH103 | Physics for Computer Professionals | 3 | - | - | 3 | ISE 1 | 10 | | 40 |
| | | | | | | | MSE | 30 | | |
| | | | | | | | ISE 2 | 10 | | |
| | | | | | | | ESE | 50 | 20 | |
| BS | 4MA102 | Engineering Mathematics II | 3 | 1 | - | 4 | ISE 1 | 10 | | 40 |
| | | | | | | | MSE | 30 | | |
| | | | | | | | ISE 2 | 10 | | |
| | | | | | | | ESE | 50 | 20 | |
| ES | 4ME101 | Basic Mechanical Engineering | 2 | - | - | 2 | ISE 1 | 10 | | 40 |
| | | | | | | | MSE | 30 | | |
| | | | | | | | ISE 2 | 10 | | |
| | | | | | | | ESE | 50 | 20 | |
| ES | 4EL101 | Basic Electrical Engineering | 2 | - | - | 2 | ISE 1 | 10 | | 40 |
| | | | | | | | MSE | 30 | | |
| | | | | | | | ISE 2 | 10 | | |
| | | | | | | | ESE | 50 | 20 | |
| ES | 4EN101 | Basic Electronics Engineering | 2 | - | - | 2 | ISE 1 | 10 | | 40 |
| | | | | | | | MSE | 30 | | |
| | | | | | | | ISE 2 | 10 | | |
| | | | | | | | ESE | 50 | 20 | |
| HS | 4HS101 | English for Professional Communication | 2 | 1 | - | 3 | ISE 1 | 10 | | 40 |
| | | | | | | | MSE | 30 | | |
| | | | | | | | ISE 2 | 10 | | |
| | | | | | | | ESE | 50 | 20 | |
| BS | 4PH151 | Engineering Physics Laboratory | - | - | 2 | 1 | ISE | 100 | 40 | |
| ES | 4EN151 | Electronics Engineering Laboratory | - | - | 2 | 1 | ISE | 100 | 40 | |
| ES | 4CS153 | Computer Programming | 0 | - | 4 | 2 | ISE | 100 | 40 | |
| Total | | | **14** | **2** | **8** | **20** | **Total Credits: 20**<br>**Total Contact Hrs: 24** | | | |

**Walchand College of Engineering, Sangli**
(An Autonomous Institute)
Teaching and Evaluation Scheme effective from 2019-2020
**Second year B. Tech. Program in Computer Science and Engineering**
Semester I

| Course | | | Teaching Scheme | | | | Evaluation Scheme | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Category | Code | Name | L | T | P | Credits | Component | Marks: Max | Marks: Min for Passing | |
| BS | 4CS201 | Applied Mathematics for Computer Science and Engineering | 3 | 0 | 0 | 3 | ISE 1 | 10 | | 40 |
| | | | | | | | MSE | 30 | | |
| | | | | | | | ISE 2 | 10 | | |
| | | | | | | | ESE | 50 | 20 | |
| PC | 4CS202 | Discrete Mathematics | 3 | 1 | 0 | 4 | ISE 1 | 10 | | 40 |
| | | | | | | | MSE | 30 | | |
| | | | | | | | ISE 2 | 10 | | |
| | | | | | | | ESE | 50 | 20 | |
| PC | 4CS203 | Data Structures | 3 | 0 | 0 | 3 | ISE 1 | 10 | | 40 |
| | | | | | | | MSE | 30 | | |
| | | | | | | | ISE 2 | 10 | | |
| | | | | | | | ESE | 50 | 20 | |
| PC | 4CS204 | Data Communication | 3 | 0 | 0 | 3 | ISE 1 | 10 | | 40 |
| | | | | | | | MSE | 30 | | |
| | | | | | | | ISE 2 | 10 | | |
| | | | | | | | ESE | 50 | 20 | |
| PC | 4CS205 | Computer Organization and Architecture | 3 | 0 | 0 | 3 | ISE 1 | 10 | | 40 |
| | | | | | | | MSE | 30 | | |
| | | | | | | | ISE 2 | 10 | | |
| | | | | | | | ESE | 50 | 20 | |
| HS | 4HS203 | Environmental Science | 2 | 1 | 0 | 3 | ISE 1 | 10 | | 40 |
| | | | | | | | MSE | 30 | | |
| | | | | | | | ISE 2 | 10 | | |
| | | | | | | | ESE | 50 | 20 | |
| PC | 4CS251 | Data Structures Laboratory | 0 | 0 | 2 | 1 | ISE | 50 | 20 | |
| | | | | | | | ESE | 50 | 20 | |
| PC | 4CS252 | Computer Organization and Architecture Lab | 0 | 0 | 2 | 1 | ISE | 50 | 20 | |
| | | | | | | | ESE | 50 | 20 | |
| PC | 4CS253 | Programming Laboratory 1 | 0 | 0 | 4 | 2 | ISE | 50 | 20 | |
| | | | | | | | ESE | 50 | 20 | |
| Total | | | 17 | 2 | 8 | 23 | **Total Credits: 23**<br>**Total Contact Hrs: 27** | | | |

**Walchand College of Engineering, Sangli**
(An Autonomous Institute)
Teaching and Evaluation Scheme effective from 2019-2020
**Second year B. Tech. Program in Computer Science and Engineering**
Semester II

| Course | | | Teaching Scheme | | | | Evaluation Scheme | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Category** | **Code** | **Name** | **L** | **T** | **P** | **Credits** | **Component** | **Marks** | | |
| | | | | | | | | **Max** | **Min for Passing** | |
| HS | 4HS201/ 4HS202 | Development of Societies/Philosophy | 2 | 0 | 0 | 2 | ISE 1 | 10 | | 40 |
| | | | | | | | MSE | 30 | | |
| | | | | | | | ISE 2 | 10 | | |
| | | | | | | | ESE | 50 | 20 | |
| PC | 4CS221 | Software Engineering | 3 | 0 | 0 | 3 | ISE 1 | 10 | | 40 |
| | | | | | | | MSE | 30 | | |
| | | | | | | | ISE 2 | 10 | | |
| | | | | | | | ESE | 50 | 20 | |
| PC | 4CS222 | Formal Language and Automata Theory | 3 | 1 | 0 | 4 | ISE 1 | 10 | | 40 |
| | | | | | | | MSE | 30 | | |
| | | | | | | | ISE 2 | 10 | | |
| | | | | | | | ESE | 50 | 20 | |
| PC | 4CS223 | Operating Systems | 3 | 0 | 0 | 3 | ISE 1 | 10 | | 40 |
| | | | | | | | MSE | 30 | | |
| | | | | | | | ISE 2 | 10 | | |
| | | | | | | | ESE | 50 | 20 | |
| PC | 4CS224 | Database Engineering | 3 | 0 | 0 | 3 | ISE 1 | 10 | | 40 |
| | | | | | | | MSE | 30 | | |
| | | | | | | | ISE 2 | 10 | | |
| | | | | | | | ESE | 50 | 20 | |
| PC | 4CS225 | Computer Network | 3 | 0 | 0 | 3 | ISE 1 | 10 | | 40 |
| | | | | | | | MSE | 30 | | |
| | | | | | | | ISE 2 | 10 | | |
| | | | | | | | ESE | 50 | 20 | |
| PC | 4CS271 | Database Engineering Laboratory | 0 | 0 | 2 | 1 | ISE | 50 | 20 | |
| | | | | | | | ESE | 50 | 20 | |
| PC | 4CS272 | Computer Network Laboratory | 0 | 0 | 2 | 1 | ISE | 50 | 20 | |
| | | | | | | | ESE | 50 | 20 | |
| PC | 4CS273 | Programming Laboratory 2 | 0 | 0 | 4 | 2 | ISE | 50 | 20 | |
| | | | | | | | ESE | 50 | 20 | |
| Total | | | 17 | 1 | 8 | 22 | **Total Credits: 22**<br>**Total Contact Hrs: 26** | | | |

**Walchand College of Engineering, Sangli**
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Teaching and Evaluation Scheme effective from 2020-21
**Third year B. Tech. Program in Computer Science and Engineering**
Semester I

| **Course** | | | **Teaching Scheme** | | | | **Evaluation Scheme** | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Category** | **Code** | **Name** | **L** | **T** | **P** | **Credits** | **Component** | **Marks** | | |
| | | | | | | | | **Max** | **Min for Passing** | |
| OE | 4OE3** | Open Elective 1 | 3 | 0 | 0 | 3 | ISE 1 | 10 | | 40 |
| | | | | | | | MSE | 30 | | |
| | | | | | | | ISE 2 | 10 | | |
| | | | | | | | ESE | 50 | 20 | |
| HS | 4HS 307/401 | Fundamentals of Management and Economics for Engineers | 4 | 0 | 0 | 4 | ISE 1 | 10 | | 40 |
| | | | | | | | MSE | 30 | | |
| | | | | | | | ISE 2 | 10 | | |
| | | | | | | | ESE | 50 | 20 | |
| PC | 4CS301 | Compiler Design | 3 | 1 | 0 | 4 | ISE 1 | 10 | | 40 |
| | | | | | | | MSE | 30 | | |
| | | | | | | | ISE 2 | 10 | | |
| | | | | | | | ESE | 50 | 20 | |
| PC | 4CS302 | Design and Analysis of Algorithms | 3 | 0 | 0 | 3 | ISE 1 | 10 | | 40 |
| | | | | | | | MSE | 30 | | |
| | | | | | | | ISE 2 | 10 | | |
| | | | | | | | ESE | 50 | 20 | |
| PE | 4CS3** | Professional Elective 1 | 3 | 0 | 0 | 3 | ISE 1 | 10 | | 40 |
| | | | | | | | MSE | 30 | | |
| | | | | | | | ISE 2 | 10 | | |
| | | | | | | | ESE | 50 | 20 | |
| PC | 4CS351 | Design and Analysis of Algorithms Laboratory | 0 | 0 | 2 | 1 | ISE | 50 | 20 | |
| | | | | | | | ESE | 50 | 20 | |
| PC | 4CS352 | Computer Graphics Laboratory | 2 | 0 | 2 | 3 | ISE | 50 | 20 | |
| | | | | | | | ESE | 50 | 20 | |
| PC | 4CS353 | Mini Project 1 (based on Machine learning / Image Processing / Internet (Web) of Things) | 0 | 0 | 2 | 1 | ISE | 50 | 20 | |
| | | | | | | | ESE | 50 | 20 | |
| PC | 4CS354 | Programming Laboratory 3 | 0 | 0 | 4 | 2 | ISE | 50 | 20 | |
| | | | | | | | ESE | 50 | 20 | |
| Total | | | 18 | 1 | 10 | 24 | **Total Credits: 24**<br>**Total Contact Hrs: 29** | | | |

| **Professional Electives 1** | |
|---|---|
| 4CS311 | Machine learning |
| 4CS312 | Image Processing |
| 4CS313 | Internet (Web) of Things |

| **Open Elective 1** | | |
|---|---|---|
| **Course Code** | **Course Name** | **Offered by** |
| 4OE 315 | Remote Sensing & GIS, GPS | Civil Engg., |
| 4OE329 | Manufacturing Engineering | Mechanical |
| 4OE330 | Energy Engineering | Mechanical |
| 4OE331 | Mechanisms & Machines | Mechanical |
| 4OE 343 | Electrical Machine Technology | Electrical |
| 4OE 357 | Electronic Systems | Electronics Engg., |
| 4OE 371 | Software Engineering and Database Essentials | CSE |
| 4OE 372 | Algorithms and Applications | CSE |
| 4OE 385 | Internet of Things | IT |
| 4OE 386 | Python | IT |
| 4OE 387 | FOSS | IT |

**Walchand College of Engineering, Sangli**
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Teaching and Evaluation Scheme effective from 2020-21
**Third year B. Tech. Program in Computer Science and Engineering**
Semester II

| **Course** | | | **Teaching Scheme** | | | | **Evaluation Scheme** | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Category** | **Code** | **Name** | **L** | **T** | **P** | **Credits** | **Component** | **Marks** | | |
| | | | | | | | | **Max** | **Min for Passing** | |
| OE | 4OE3** | Open Elective 2 | 3 | 0 | 0 | 3 | ISE 1 | 10 | | 40 |
| | | | | | | | MSE | 30 | | |
| | | | | | | | ISE 2 | 10 | | |
| | | | | | | | ESE | 50 | 20 | |
| HS | 4HS3** | Elective Foundation Course in Humanities | 3 | 0 | 0 | 3 | ISE 1 | 10 | | 40 |
| | | | | | | | MSE | 30 | | |
| | | | | | | | ISE 2 | 10 | | |
| | | | | | | | ESE | 50 | 20 | |
| PC | 4CS321 | Distributed System and Cloud Computing | 3 | 0 | 0 | 3 | ISE 1 | 10 | | 40 |
| | | | | | | | MSE | 30 | | |
| | | | | | | | ISE 2 | 10 | | |
| | | | | | | | ESE | 50 | 20 | |
| PC | 4CS322 | Advanced Database System | 3 | 0 | 0 | 3 | ISE 1 | 10 | | 40 |
| | | | | | | | MSE | 30 | | |
| | | | | | | | ISE 2 | 10 | | |
| | | | | | | | ESE | 50 | 20 | |
| PE | 4CS3** | Professional Elective 2 | 3 | 0 | 0 | 3 | ISE 1 | 10 | | 40 |
| | | | | | | | MSE | 30 | | |
| | | | | | | | ISE 2 | 10 | | |
| | | | | | | | ESE | 50 | 20 | |
| PE | 4CS3** | Professional Electives 1 Laboratory | 0 | 0 | 4 | 2 | ISE | 50 | 20 | |
| | | | | | | | ESE | 50 | 20 | |
| PC | 4CS371 | Advanced Database System Laboratory | 0 | 0 | 2 | 1 | ISE | 50 | 20 | |
| | | | | | | | ESE | 50 | 20 | |
| PC | 4CS341 | Mini Project 2 | 0 | 0 | 2 | 1 | ISE | 50 | 20 | |
| | | | | | | | ESE | 50 | 20 | |
| Total | | | 15 | 0 | 8 | 19 | **Total Credits: 19**<br>**Total Contact Hrs: 23** | | | |

**Professional electives on theory courses may also be opted by students of other programme.**

| **Elective Foundation Course in Humanities** | | | |
|---|---|---|---|
| 4HS 301 | Law and Engineering | 4HS 304 | Psychology |
| 4HS 302 | Ethics and Holistic Life | 4HS 305 | Sanskrit/Foreign language |
| 4HS 303 | Education, Technology and Society | 4HS 306 | Human Relations at Work |

| **Professional Electives 1 Laboratory** | |
|---|---|
| 4CS381 | Advanced Web programming Laboratory |
| 4CS382 | Software Tools Laboratory |
| **Professional Elective 2** | |
| 4CS331 | Soft Computing |
| 4CS332 | Computer Vision |
| 4CS333 | Advanced Computer Network |
| 4CS334 | Remote Sensing and Geographic Information System |

| **Open Elective 2** | | |
|---|---|---|
| **Course Code** | **Course Name** | **Offered by** |
| 4OE 309 | Theory of Structures | Applied Mechanics |
| 4OE 336 | Power Plant Engineering | Mechanical |
| 4OE 337 | Fabrication Tech. | Mechanical |
| 4OE 338 | Mech. Power Transmission | Mechanical |
| 4OE350 | Renewable Energy | Electrical |
| 4OE366 | Biomedical Instrumentation | Electronics |
| 4OE378 | Data Analytics | CSE |
| 4OE379 | Network Essentials | CSE |
| 4OE392 | Web Design | IT |
| 4OE393 | Cloud and virtualization | IT |
| 4OE394 | Game Development | IT |

**Walchand College of Engineering, Sangli**
(An Autonomous Institute)
Teaching and Evaluation Scheme from year 2021-22
**Final year B. Tech. Program in Computer Science and Engineering**
Semester I

| Course | | | Teaching Scheme | | | | Evaluation Scheme | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Category** | **Code** | **Name** | **L** | **T** | **P** | **Credits** | **Component** | **Marks** | | |
| | | | | | | | | **Max** | **Min for Passing** | |
| OE | 4OE4** | Open Elective 3 | 3 | 0 | 0 | 3 | ISE 1 | 10 | | 40 |
| | | | | | | | MSE | 30 | | |
| | | | | | | | ISE 2 | 10 | | |
| | | | | | | | ESE | 50 | 20 | |
| PC | 4CS401 | Information Security | 3 | 0 | 0 | 3 | ISE 1 | 10 | | 40 |
| | | | | | | | MSE | 30 | | |
| | | | | | | | ISE 2 | 10 | | |
| | | | | | | | ESE | 50 | 20 | |
| PE | 4CS4** | Professional Elective 3 | 3 | 0 | 0 | 3 | ISE 1 | 10 | | 40 |
| | | | | | | | MSE | 30 | | |
| | | | | | | | ISE 2 | 10 | | |
| | | | | | | | ESE | 50 | 20 | |
| PE | 4CS4** | Professional Elective 4 | 3 | 0 | 0 | 3 | ISE 1 | 10 | | 40 |
| | | | | | | | MSE | 30 | | |
| | | | | | | | ISE 2 | 10 | | |
| | | | | | | | ESE | 50 | 20 | |
| PC | 4CS451 | Information Security Laboratory | 0 | 0 | 2 | 1 | ISE | 50 | 20 | |
| | | | | | | | ESE | 50 | 20 | |
| PE | 4CS4** | Professional Elective 2 Laboratory | 0 | 0 | 2 | 1 | ISE | 50 | 20 | |
| | | | | | | | ESE | 50 | 20 | |
| PC | 4CS441 | Project 1 and Seminar | 0 | 0 | 6* | 3 | ISE | 100 | 40 | |
| MC | 4IC402 | Essence of Indian Traditional Knowledge | 2 | 0 | 0 | 0 | ISE 1 | 35 | 40 | |
| | | | | | | | MSE | 30 | | |
| | | | | | | | ISE 2 | 35 | | |
| Total | | | 14 | 0 | 10 | 17 | **Total Credits: 17**<br>**Total Contact Hrs: 24** | | | |

*Indicates contact hours per week per project batch of 8-10 students.

| **Professional Electives 2 Laboratory** | |
|---|---|
| 4CS461 | High Performance Computing Laboratory |
| 4CS462 | Data Mining Laboratory |
| **Professional Elective 3** | |
| 4CS411 | High Performance Computing |
| 4CS412 | Data Mining |
| **Professional Elective 4** | |
| 4CS413 | Advanced Machine Learning |
| 4CS414 | Software Defined Network |
| 4CS415 | Intelligent Systems |

| **Open Elective 3** | | |
|---|---|---|
| **Course Code** | **Course Name** | **Offered by** |
| 4OE 402 | Finite Element Method | APM |
| 4OE 416 | Concrete Engineering and Technology | Civil |
| 4OE 429 | Auto. Engg | Mechanical |
| 4OE 430 | Aerospace Engg | Mechanical |
| 4OE 431 | Ind. Automation | Mechanical |
| 4OE 443 | Industrial Automation | Electrical |
| 4OE 457 | Cyber Physical Systems | Electronics |
| 4OE458 | Automobile Electronics | Electronics |
| 4OE 471 | Cyber Security | CSE |
| 4OE 485 | Data Visualization & Interpretation | IT |
| 4OE 486 | Social Network Analysis | IT |
| 4OE 487 | Basics of Soft Computing | IT |

**Walchand College of Engineering, Sangli**
(An Autonomous Institute)
Teaching and Evaluation Scheme from year 2021-22
**Final year B. Tech. Program in Computer Science and Engineering**
Semester II

<table>
<tr><th colspan="3">Course</th><th colspan="4">Teaching Scheme</th><th colspan="4">Evaluation Scheme</th></tr>
<tr><th rowspan="2">Category</th><th rowspan="2">Code</th><th rowspan="2">Name</th><th rowspan="2">L</th><th rowspan="2">T</th><th rowspan="2">P</th><th rowspan="2">Credits</th><th rowspan="2">Component</th><th colspan="3">Marks</th></tr>
<tr><th>Max</th><th colspan="2">Min for Passing</th></tr>
<tr><td rowspan="4">PE</td><td rowspan="4">4CS4**</td><td rowspan="4">Professional Elective 5</td><td rowspan="4">3</td><td rowspan="4">0</td><td rowspan="4">0</td><td rowspan="4">3</td><td>ISE 1</td><td>10</td><td rowspan="3"></td><td rowspan="4">40</td></tr>
<tr><td>MSE</td><td>30</td></tr>
<tr><td>ISE 2</td><td>10</td></tr>
<tr><td>ESE</td><td>50</td><td>20</td></tr>
<tr><td rowspan="4">PE</td><td rowspan="4">4CS4**</td><td rowspan="4">Professional Elective 6</td><td rowspan="4">3</td><td rowspan="4">0</td><td rowspan="4">0</td><td rowspan="4">3</td><td>ISE 1</td><td>10</td><td rowspan="3"></td><td rowspan="4">40</td></tr>
<tr><td>MSE</td><td>30</td></tr>
<tr><td>ISE 2</td><td>10</td></tr>
<tr><td>ESE</td><td>50</td><td>20</td></tr>
<tr><td rowspan="2">PC</td><td rowspan="2">4CS491</td><td rowspan="2">Project 2</td><td rowspan="2">0</td><td rowspan="2">0</td><td rowspan="2">8*</td><td rowspan="2">8</td><td>ISE</td><td>50</td><td colspan="2">20</td></tr>
<tr><td>ESE</td><td>50</td><td colspan="2">20</td></tr>
<tr><td>PC</td><td>4CS492</td><td>Summer internship#</td><td>0</td><td>0</td><td>0</td><td>1</td><td>ISE</td><td>100</td><td colspan="2">40</td></tr>
<tr><td>PC</td><td>4CS493</td><td>Techno-Socio Outreach</td><td>0</td><td>0</td><td>2</td><td>1</td><td>ISE</td><td>100</td><td colspan="2">40</td></tr>
<tr><td rowspan="3">MC</td><td rowspan="3">4IC401</td><td rowspan="3">Indian Constitution</td><td rowspan="3">2</td><td rowspan="3">0</td><td rowspan="3">0</td><td rowspan="3">0</td><td>ISE 1</td><td>35</td><td colspan="2" rowspan="3">40</td></tr>
<tr><td>MSE</td><td>30</td></tr>
<tr><td>ISE 2</td><td>35</td></tr>
<tr><td colspan="3">Total</td><td>8</td><td>0</td><td>10</td><td>16</td><td colspan="4">Total Credits: 16<br>Total Contact Hrs: 18</td></tr>
</table>

# indicates internship to be completed during summer vacations after second year but before Final year semester I.

| **Professional Electives 5** | |
|---|---|
| 4CS431 | Computer Forensic |
| 4CS432 | Search Engine Design and Optimization |
| **Professional Electives 6** | |
| 4CS433 | Human Computer Interaction |
| 4CS434 | Social Networks |

| Semester | I | II | III | IV | V | VI | VII | VIII | Total |
|---|---|---|---|---|---|---|---|---|---|
| Credits | 19 | 20 | 23 | 22 | 24 | 19 | 17 | 16 | 160 |

**Walchand College of Engineering, Sangli**
(An Autonomous Institute)
**Curriculum Comparison for WCE and AICTE**
**B. Tech.**

| Sr. No. | Category | Computer Science and Engineering | | | |
|---|---|---|---|---|---|
| | | Credits | | % | |
| | | AICTE | DEPT | AICTE | DEPT |
| 1 | HS | 12 | 15 | 7.5 | 9.4 |
| 2 | BS | 24 | 21 | 15.1 | 13.1 |
| 3 | ES | 29 | 18 | 18.2 | 11.3 |
| 4 | PC | 49 | 63 | 30.8 | 39.4 |
| 5 | PE | 18 | 21 | 11.3 | 13.1 |
| 6 | OE | 12 | 9 | 7.5 | 5.6 |
| 7 | PC | 15 | 13 | 9.4 | 8.1 |
| 8 | MC | 0 | 0 | 0 | 0 |
| **Total Credits** | | **159** | **160** | **100** | **100** |

| Category |
|---|
| Humanities and Social Sciences including Management courses (HS) |
| Basic Science courses (BS) |
| Engineering Science courses (ES) |
| Professional core courses (PC) |
| Professional Elective courses relevant to chosen specialization/branch[&] (PE) |
| Open subjects – Electives from other technical and /or emerging subjects (OE) |
| Project work, seminar and internship in industry or elsewhere (PC) |
| Mandatory Non- credit Courses (MC) |

**Additional Minor Engineering with additional 20 credits through SWAYAM/MOOCS**

Student/s will be awarded an *additional Minor Engineering* along with B. Tech.(Computer Science and Engineering) if he/she completes an additional 20 credits **through SWAYAM/MOOCS.**

# Walchand College of Engineering, Sangli

(An Autonomous Institute)

# Curriculum (Structure and Syllabus)

# for

# ***First Year B. Tech.***

# ***Computer Science and Engineering***

# With effective from

# Academic Year 2018-19

| **Title of the Course: Chemistry for Computer Professionals 4CH103** | L | T | P | Cr |
|---|---|---|---|---|
| | 03 | 0 | 0 | 03 |

**Pre-Requisite Courses: Chemistry course at secondary and higher secondary level**

**Textbooks:** 1. S.K. Singh, "Engineering Chemistry", New Age Publication, 3rd Edition , 2005.
2. Shasi Chawla, "Engineering Chemistry", Dhanpat Rai Publication, 3rd Edition , 2003.
3. Jain P.C. and Jain Monika, "Engineering Chemistry", Dhanpat Rai Publication, 16th Edition, 2013.

**References:**

1. O G Palanna, "Engineering Chemistry" Tata McGraw Hill 2009.
2. J Mendham, R.C. Denney, J.D. Barnes, M.J.K Thomas, "Quantitative Chemical analysis", Vogel's Pearson Education, 6th Edition , 2008.
3. S.S Dara, "Engineering Chemistry" S. Chand and Company 2008.
4. Askeland and Phule , "The Science and Engineering of Materials" Thomson Publication 4th Edition ,2003

**Course Objectives :**

1. To make student familiar with engineering properties associated with different materials to use them successfully in practice.
2. To provide knowledge on methods of characterization and chemical analysis.

**Course Learning Outcomes:**

| **CO** | **After the completion of the course the student should be able to** | Bloom's Cognitive | |
|---|---|---|---|
| | | level | Descriptor |
| **CO1** | **Explain** chemical analysis, water chemistry, phase rule, energy science and electronic engineering materials and water's industrial applications. **Draw** schematic of water softeners, phase diagrams, film deposition techniques and spectroscopy. | II | Understanding |
| **CO2** | **Classify** types of chemical analysis, hard water, fuel cell, modern techniques, engineering materials and thin film deposition techniques. | II | Understanding |
| **CO3** | **Calculate** concentration of solutions, hardness of water, wave number, frequency, wavelength, energy associated with radiations, Calorific value. | III | Applying |

**CO-PO Mapping:**

**CSE**

| **PO** | **a** | **b** | **c** | **d** | **e** | **f** | **g** | **h** | **i** | **j** | **k** |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | **2** | | | | | | | | | | **1** |
| **CO2** | **2** | | | | | | | | | | **1** |
| **CO3** | **2** | | | | | | | | | | **1** |

**Assessments :**
**Teacher Assessment:**
Two components of In Semester Evaluation (ISE), One Mid Semester Examination (MSE) and one End Semester Examination (ESE) having 20%, 30% and 50% weights respectively.

| Assessment | Marks |
|---|---|
| ISE 1 | 10 |
| MSE | 30 |
| ISE 2 | 10 |
| ESE | 50 |

ISE 1 and ISE 2 are based on assignment/declared test/quiz/seminar etc.
MSE: Assessment is based on 50% of course content (Normally first three modules)
ESE: Assessment is based on 100% course content with 70-80% weightage for course content (normally last three modules) covered after MSE.

**Course Contents:**

| | |
|---|---|
| **Module 1. General principles of chemical Analysis -** Chemical analysis, Its types, Advantages and Disadvantages of instrumental and non-instrumental methods, Different ways to express concentration of solution. Numerical problems. Standards and its types. Titrimetric analysis, Definition of terms associated with titrimetry. Classification of titrimetry, Gravimetry and its requirements, applications. | **07Hrs** |
| | |
| **Module 2 Water Chemistry -** Natural sources of water, Impurities in natural water. Water quality parameters Hardness**-** Definition, Causes, Types, Expressing hardness, units to measure hardness, Numerical problems on hardness calculation, ill effects of hard water in steam generation, Alkalinity, Chloride , Dissolved oxygen(DO), Biological Oxygen Demand (BOD) and Chemical Oxygen Demand (COD) its significance. Ion exchange method of water softening. | **7Hrs.** |
| | |
| **Module 3- Phase Rule:** Gibbs phase rule, Explanation of the terms Phase, Component, Degree of freedom, Phase reactions, types of equilibrium, equilibrium conditions. One component system-Water system, Sulphur system, Two component system- Lead Silver system, Application of Eutectic system, Merit and Demerits of Phase rule. | **6Hrs.** |
| | |
| **Module 4**.**Energy Science**: Fuel and its classification, Characteristics of good fuel, Properties of solid, liquid and gaseous fuels. Calorific value, Gross and net calorific value, its units, and determination by bomb and Boys calorimeter, Numerical problems on calorific value. Fuel cell, its types and applications. | **6Hrs.** |
| | |
| **Module 5 Modern Analytical Techniques-** EM radiation and Electromagnetic spectrum, Interaction of matter and EM radiation, UV-Visible spectrophotometry, Atomic absorption spectroscopy w.r.t. Principle, Instrumentation, Calibration, Applications. Chromatography, account of Gas Liquid chromatography. | **7Hrs.** |
| | |
| **Module 6 Electronic Engineering Materials:** Material, Engineering Materials and types of engineering materials, Bulk materials and Thin films materials, Thin film definition, Requirements of ideal thin films, Thin film deposition techniques Physical Vapor Deposition (PVD), Chemical Vapor deposition (CVD) w.r.t. equipment, precursor. Comparison, applications of thin films in storage devices. | **7Hrs.** |
| | |

| |
|---|
| **Module wise Measurable Students Learning Outcomes :**<br>**After the completion of the course the student should be able to:**<br>**1: E**xplain and select chemical method of analysis.<br>**2:** Decide suitability of available water towards various industrial applications.<br>**3:** Describe one and two component systems and terms associated with respect to heterogeneous systems.<br>**4:** Describe and determine calorific value by different methods. Solve combustion related problems<br>**5:** Compare and contrast different modern analysis techniques<br>**6**: Choose proper substrate, precursor and method of deposition as per required characteristics |
| |

| **Title of the Course: Engineering Mathematics I 4MA101** | L | T | P | Cr |
|---|---|---|---|---|
| | **3** | **1** | **-** | **4** |

**Pre-Requisite Courses:** Mathematics course at Higher Secondary Junior College

**Textbooks:**

1. P. N. and J. N. Wartikar "A Text Book of Applied Mathematics, Vol I and II, Vidyarthi Griha Prakashan, Pune, 2006.
2. B .S. Grewal "Higher Engineering Mathematics", , Khanna Publication, 44th Edition, 2017.

**References:**

1. Erwin Kreyszig , "Advanced Engineering Mathematics", , Wiley Eastern Limited Publication, 10th Edition, 2015.
2. Wylie C.R "*Advanced Engineering Mathematics",*., Tata McGraw Hill Publication, 8th Edition 1999.
3. H. K. Dass, "*Advanced Engineering Mathematics",* S. Chand & Company Ltd., 1st Edition, 2014.
4. B.V.Ramana, "Higher Engineering Mathematics ", The McGraw Hill companies, 2006.

**Course Objectives :**

1) Introduce the basic concepts required to understand, construct, solve and interpret various types

of differential equation.

2) Give an ability to apply knowledge of Mathematics on Engineering problems.

**Course Learning Outcomes:**

| **CO** | **After the completion of the course the student should be able to** | Bloom's Cognitive | |
|---|---|---|---|
| | | level | Descriptor |
| **CO1** | Explain mathematical concepts relevant to address problems in engineering field. | II | Understanding |
| **CO2** | Solve engineering and scientific problems. | III | Applying |
| | | | |

**CO-PO Mapping :**
**Computer Science and Engineering :**

| | **a** | **b** | **c** | **d** | **e** | **f** | **g** | **h** | **i** | **j** | **k** |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | **2** | | | | **1** | | | | | | |
| **CO2** | **2** | | | | **1** | | | | | | |

**Assessments :**
**Teacher Assessment:**
Two components of In Semester Evaluation (ISE), One Mid Semester Examination (MSE) and one End Semester Examination (ESE) having 20%, 30% and 50% weights respectively.

| Assessment | Marks |
|---|---|
| ISE 1 | 10 |

| | |
|---|---|
| MSE | 30 |
| ISE 2 | 10 |
| ESE | 50 |

ISE 1 and ISE 2 are based on assignment/declared test/quiz/seminar etc.
MSE: Assessment is based on 50% of course content (Normally first three modules)
ESE: Assessment is based on 100% course content with60-70% weightage for course content (normally last three modules) covered after MSE.

**Course Contents:**

| | |
|---|---|
| **Module 1 : Matrices**<br>Rank of matrix, Homogeneous and non-homogeneous linear equations, symmetric and skew symmetric and orthogonal matrices, Eigen values, Eigen vectors, Cayley Hamilton theorem, Diagonalisation of matrices. | **6Hrs.** |
| **Module 2: Calculus**<br>Rolle's theorem, Mean value theorem, Taylor's and Maclaurin's theorem with remainders, L'hospital rule and indeterminate forms | **6Hrs.** |
| **Module 3: Complex Number**<br>Polar form of complex number, Argand's diagram, De Moiver's theorem, roots of complex number, Hyperbolic function, exponential form of complex number, relation between circular and hyperbolic function. | **7Hrs.** |
| **Module 4: Partial Differentiation and its application**<br>Partial derivative, chain rule for partial differentiation, Euler's theorem for homogeneous and non-homogeneous function, Jacobian, Error and approximation, maxima and minima of function of two variables. | **8Hrs.** |
| **Module 5: First order ordinary differential equation and its application**<br>Exact, Linear, Bernoulli's equations, Euler's equations, Orthogonal trajectory, applications to simple electric circuit. | **8Hrs.** |
| **Module 6: Curve tracing**<br>Tracing of curves for Cartesian and polar coordinate. | **5Hrs.** |

**Module wise measurable students learning outcome:**

After the completion of the course the student should be able to

**Module 1 : Matrices**

solve problems related with matrices.

**Module 2: Calculus**

solve problems in calculus.

**Module 3: Complex Number**

solve problems in complex number.

**Module 4: Partial Differentiation and its application**

solve problems of partial differentiation

**Module 5: First order ordinary differential equation and its application**

explain and solve problems in First order ordinary differential equation.

**Module 6: Curve tracing**

trace the different curves.

**Tutorial:**

During the tutorial we will ensure that the students have properly learnt the topics covered in the lectures. This shall include assignments, quiz, surprise test or declare test. The teacher may add another activity.

| **Title of the Course: Introduction to Engineering Mechanics 4AM102** | L | T | P | Cr |
|---|---|---|---|---|
| | 2 | 0 | 0 | 2 |

**Pre-Requisite Courses:** Physics

**Textbooks:**
1. Ramamrutham., S. *"Textbook of Applied Mechanics",* Dhanpat Rai Publishing Company Limited, 2008.
2. Bhavikatti., S. S. and Rajashekarappa., K. G. *"Engineering Mechanics",* New Age International Publishers, 2015, 5th Edition.
3. Khurmi. R. S., *"Textbook of Applied Mechanics",* Tata McGraw Hill Publishing Company, 2013, 20th Revised Edition.

**References:**
1. Beer, F. P. and Johnston, E. R. *"Vector Mechanics for Engineers Vol. I and II",* McGraw Hill Company Publication, 2011, 9th Edition.
2. Singer, F. L. *"Engineering Mechanics Statics & Dynamics",* B. S. Publications, 2011.
3. Timoshenko, S. and Young, D. H. *"Engineering Mechanics"*, McGraw Hill Companies, 2008, 4th Edition.
4. Meriam, L. and L.G. Kraige, "*Engineering Mechanics – Dynamics",* John Wiley & Sons, 2002, 6th Edition.

**Course Objectives :**
1. To impart knowledge of mechanics concepts applicable to civil and mechanical engineering.
2. To illustrate behavior of static bodies using mechanics concepts.
3. To provide knowledge of motions, forces and work energy principles and its engineering applications.

**Course Learning Outcomes:**

| **CO** | **After the completion of the course the student should be able to** | Bloom's Cognitive | |
|---|---|---|---|
| | | Level | Descriptor |
| **CO1** | **Apply** laws and basic principles of mechanics of rigid bodies. | II | Understanding |
| **CO2** | **Analyze** system of forces in Statics and Dynamics. | IV | Analyzing |
| **CO3** | **Apply** concept of mechanics to solve engineering problems. | III | Applying |

**CO-PO Mapping:**
**CSE**

| **PO** | **a** | **b** | **c** | **d** | **e** | **f** | **g** | **h** | **i** | **j** | **k** |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | | | | | | | | | | | **1** |
| **CO2** | | | | | | | | | | | **1** |
| **CO3** | | | | | | | | | | | **1** |

**Assessments :**
**Teacher Assessment:**
Two components of In Semester Evaluation (ISE), One Mid Semester Examination (MSE) and one End Semester Examination (ESE) having 20%, 30% and 50% weights respectively.

| Assessment | Marks |
|---|---|

| | |
|---|---|
| ISE 1 | 10 |
| MSE | 30 |
| ISE 2 | 10 |
| ESE | 50 |

ISE 1 and ISE 2 are based on assignment/declared test/quiz/seminar etc.
MSE: Assessment is based on 50% of course content (Normally first three modules)
ESE: Assessment is based on 100% course content with 70-80% weightage for course content (normally last three modules) covered after MSE.

**Course Contents:**

| **Module 1: Introduction to mechanics** | **Hrs.** |
|---|---|
| Units, Particle, Elastic & Rigid Bodies, Scalar & Vector Quantities. Force, Resolution and composition of forces, Laws of Mechanics, Moment, Couple. | **5** |
| **Module 2: Equilibrium** | **Hrs.** |
| Concept of equilibrium, Conditions of equilibrium, free body diagram, Lami's theorem, Reactions of determinate beams | **4** |
| **Module 3: Moment of inertia** | **Hrs.** |
| Centre of gravity, Centroid, Moment of inertia, Radius of gyration, Parallel axes theorem, Perpendicular axes theorem, Moment of inertia of unsymmetrical sections | **5** |
| **Module 4: Kinematics of particles** | **Hrs.** |
| Rectilinear motion of a particle, equations of motion, motion under Gravity, motion of a projectile, curvilinear motion of a particle, angular motion of a particle, relation between linear and angular motion. | **5** |
| **Module 5: Kinetics of particles** | **Hrs.** |
| Newton's law of motion, D'Alemberts principle, rectilinear motion, motion on a rough inclined plane, motion of a lift, motion of connected bodies, curvilinear motion, circular motion, kinetics of rotation, torque, mass moment of inertia. | **5** |
| **Module 6: Kinetics** | **Hrs.** |
| Work energy, potential energy, kinetic energy, law of conservation of energy, Problems, impulse, momentum, collisions, impact, collision of bodies, coefficient of restitution, loss of kinetic energy due to impact. | **4** |

**Module wise Measurable Students Learning Outcomes :**
**After the completion of the course the student should be able to:**

1. Apply fundamental knowledge of engineering mechanics for rigid bodies under system of forces.
2. Apply conditions of equilibrium to determine the support reactions of determinate beams.
3. Analyse planer bodies to find sectional properties such as centre of gravity and moment of inertia.
4. Apply knowledge of kinematics of rigid body motion to solve engineering problems in dynamics
5. Apply knowledge of kinetics of rigid body motion to solve engineering problems in dynamics and recognition of the importance of safety in phases of engineering design and practice.
6. Analyze the impact of work power and energy on engineering problems.

| **Title of the Course: Basic Civil Engineering 4CV101** | L | T | P | Cr |
|---|---|---|---|---|
| | 2 | 0 | 0 | 2 |

**Pre-Requisite Courses: NIL**

**Textbooks:**

1. Gole L.G., "Introduction to Civil Engineering", Mahu Publisher House, 4th Edition, 2005
2. Bhavikatti S.S.,"Basic Civil Engineering", New Age Publications, 2010
3. Hirasakar G. K.,"Basic Civil Engineering", Dhanpat Rai publications, 1st Edition,2007

**References:**

1. Duggal S.K., "Surveying (Vol I)", Tata McGraw Hill, 4th edition 2013
2. Bindra S.P., Arora S.P. , "Building Construction", Dhanpat Rai publication, 5th edition, 2012
3. Garg S. K., "Irrigation Engineering", Dhanpat Rai publication, 24th edition, 2012

**Course Objectives :**

1. To enable the students of non-Civil Engineering branch to acquire knowledge in Civil Engineering for application oriented concepts and ideas.
2. To share the knowledge related to environment, infrastructure and property transaction.

**Course Learning Outcomes:**

| **CO** | After the completion of the course the student should be able to | **Bloom's Cognitive** | |
|---|---|---|---|
| | | **Level** | **Descriptor** |
| **CO1** | Explain concepts in Civil Engineering related to infrastructure, construction, environment and surveying. | II | Understanding |
| **CO2** | Summarize applications of Civil Engineering in various fields. | II | Understanding |
| **CO3** | Perceive the need of infrastructure development and property transaction | II | Understanding |

**CO-PO Mapping with regards to B.Tech Computer Science Engineering Programme:**

| **PO** | **a** | **b** | **c** | **d** | **e** | **f** | **g** | **h** | **i** | **j** | **k** |
|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | | | | | | | | | 1 | | |
| CO2 | | | | | | | | | 1 | 1 | 1 |
| CO3 | | | | | | | | | | 2 | 1 |

**Assessment:**

Two components of In Semester Evaluation (ISE), One Mid Semester Examination (MSE) and one End Semester Examination (ESE) having 20%, 30% and 50% weightage respectively.

| Assessment | Marks |
|---|---|

| | |
|---|---|
| ISE 1 | 10 |
| MSE | 30 |
| ISE 2 | 10 |
| ESE | 50 |

ISE 1 and ISE 2 are based on assignment, oral, seminar, test (surprise/declared/quiz), and group discussion.[One assessment tool per ISE. The assessment tool used for ISE 1 shall not be used for ISE 2]
MSE: Assessment is based on 50% of course content (Normally first three modules)
ESE: Assessment is based on 100% course content with70-80% weightage for course content (normally last three modules) covered after MSE.

| Course Contents: | |
|---|---|
| **Module 1 Introduction to Civil Engineering** | **Hrs.** |
| Basics of engineering and civil engineering; broad disciplines of Civil engineering; Importance of Civil engineering, opportunities in civil engineering, infrastructure growth and real estate management in India<br>Early constructions and developments over time; ancient monuments & modern marvels; works of eminent civil engineers<br>Surveying-definition, classification and basic principles, types of scales, chain survey, linear and angular measurements, terms used in levelling, methods of reduction of levels, use of dumpy level and auto level, Introduction and use of digital planimeter, | **6** |
| **Module 2 Fundamentals of Building Materials and Principles** | |
| Properties and uses of basic materials: cement, bricks, stone, timber, natural and artificial sand, steel, concrete, PCC, RCC, brick masonry.<br>Buildings-selection of site, types and basic functions. Basics of soil mechanics, various types of foundations.<br>Principles of building planning, introduction to building bye laws and role of bye laws in regulating the environment. Concept of built up area, carpet Area and F.S.I., concept of green building.<br>Introduction to smart cities | **6** |
| **Module 3 Basics of Construction Management & Structural Engineering** | |
| Temporary structures in construction; Construction methods for various types of Structures; Major construction equipment; automation & robotics in construction; Modern project management systems; importance of contracts management<br>Structural Engineering: Types of buildings; tall structures; various types of bridges; other structural systems; Substructure and superstructure, components & their functions; concept of strength, stability, factor of safety | **5** |
| **Module 4 Infrastructure** | |
| Investments in transport infrastructure development in India for different modes of transport; Developments and challenges in integrated transport development in India: road, rail, port and harbour and airport sector; PPP in transport sector; Intelligent Transport Systems.<br>Roads: classification, cross section and components of road, Types of pavements, road maintenance, concept of road safety audit, traffic signs, signals, road side and multistoried parking system, and causes of accidents<br>Dams: purpose, selection of site, types of dams. | **6** |
| **Module 5 Environmental Engineering & Sustainability** | |
| Water and Wastewater treatment systems; municipal and hazardous solid waste management; sustainability in construction; | **3** |
| **Module 6 Property Transaction** | |
| Land documents, property purchase and sale procedure. property selection criteria and marketability of property transaction , property taxes; introduction to building finance | **2** |
| **Module wise Measurable Students Learning Outcomes :**<br>**After the completion of the course the student should be able to:**<br>1. **Paraphrase** and **apply** fundamental knowledge of civil Engineering and use of modern surveying Instrument.<br>2. **Explain** basic principles of planning and bye Laws. Evaluate various properties of building | |

| | |
|---|---|
| materials.<br>3. **Explain c**construction Management and Structural Engineering<br>4. **Perceive and Summarize the need** of infrastructure development India.<br>5. **Explain** the importance of water treatment plant and solid waste management.<br>6. **Perceive and Summarize** the knowledge of Property transaction. | |

| Title of the Course: Engineering Graphics 4ME102 | L | T | P | Cr |
|---|---|---|---|---|
| | 1 | 0 | 4 | 3 |

**Pre-Requisite Courses:**

**Textbooks:**

1. Bhatt N.D., Panchal V.M. and Ingle P.R., Engineering Drawing, Charotar Publishing House, 2014.
2. Shah, M.B. and Rana B.C., Engineering Drawing and Computer Graphics, Pearson Education, 2008.
3. Agrawal B. and Agrawal C. M., Engineering Graphics, TMH Publication, 2012.

**References:**

1. Narayana, K.L. and P Kannaiah, Text book on Engineering Drawing, Scitech Publishers, 2008.
2. Warren J. Luzzader, Fundamentals of Engineering Drawing, Prentice Hall of India, New Delhi, 2010
3. Fredderock E. Giesecke, Alva Mitchell others, Principles of Engineering Graphics, Maxwell McMillan Publishing, 2010.

**Course Objectives :**

1. Introduce students to the conventions, concepts and basic principles of Engineering Drawing.
2. Draw projections of geometrical objects and real life components.
3. Demonstrate graphics skill for communication of concepts, ideas and design of engineering products

**Course Learning Outcomes:**

| CO | After the completion of the course the student should be able to | Bloom's Cognitive | |
|---|---|---|---|
| | | level | Descriptor |
| CO1 | **Explain** principles of Engineering and Computer Graphics | 2 | Understanding |
| CO2 | **Apply** principles of Engineering and Computer Graphics to draw projection of engineering objects | 3 | Applying |
| CO3 | **Demonstrate** Principles of Engineering, Computer Graphics through drafting software | 3 | Applying |

**CO-PO Mapping:**
**Computer Science and Engineering**

| | a | b | c | d | e | f | g | h | i | j | k | l |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | | | | | | | | | 1 | | **1** | |
| CO2 | | | | | | | | | 1 | | **1** | |
| CO3 | | | | | | | | | 1 | | **1** | |

**Assessments :**

In Semester Evaluation (ISE)

| Assessment | Marks |
|---|---|
| ISE based on drawing sheet submission (Minimum six practice and six submission sheet) | 25 |
| ISE based on declared test of drawing sheet (Minimum two) | 25 |
| ISE based on Autocad practical submission (Minimum Six submission sheets) | 25 |
| ISE based on declared test of Autocad practical submission/ oral | 25 |

Assessment is based on 100% course content with 50 % weightage for manual drafting and 50 % weightage for CAD. **Student should get minimum 40% marks for passing**.

**Course Contents:**

| | |
|---|---|
| **Module 1:** ***Introduction to Engineering Drawing*** | **Hrs.**<br>**T-2, P-4** |
| Principles of Engineering Graphics and their significance, usage of Drawing instruments, lettering, Conic sections including the Rectangular Hyperbola (General method only); Cycloid, Epicycloid, Hypocycloid and Involute; Scales – Plain, Diagonal and Vernier Scales;<br>Problems from the above units should also be practiced on computer aided drafting software. | |
| **Module 2:** ***Orthographic Projections*** | **Hrs.**<br>**T-2, P-6** |
| Principles of Orthographic Projections-Conventions - Projections of Points and lines inclined to both planes; Projections of planes inclined Planes - Auxiliary Planes;<br>Problems from the above units should also be practiced on computer aided drafting software. | |
| | |
| **Module 3:** ***Projections of Regular Solids Sections and Sectional Views of Right Angular Solids*** | **Hrs.**<br>**T-2, P-12** |
| Inclined to both the Planes- Auxiliary Views; Draw simple annotation, dimensioning and scale. Floor plans that include: windows, doors, and fixtures such as WC, bath, sink, shower, etc.<br>Prism, Cylinder, Pyramid, Cone – Auxiliary Views; Development of surfaces of Right Regular Solids - Prism, Pyramid, Cylinder and Cone; Draw the sectional orthographic views of geometrical solids, objects from industry and dwellings (foundation to slab only)<br>Problems from the above units should also be practiced on computer aided drafting software. | |
| **Module 4:** ***Isometric Projections*** | **Hrs.**<br>**T-2, P-6** |
| Principles of Isometric projection – Isometric Scale, Isometric Views, Conventions; Isometric Views of lines, Planes, Simple and compound Solids; Conversion of Isometric Views to Orthographic Views and Vice-versa, Conventions;<br>Problems from the above units should also be practiced on computer aided drafting software. | |
| **Module 5:** ***Introduction to Computer Aided Sketching*** | **Hrs.**<br>**T-2, P-12** |
| Introduction, Drawing Instruments and their uses, BIS conventions, Lettering, Dimensioning and free hand practicing. Computer screen, layout of the software, standard tool bar/menus and description of most commonly used tool bars, navigational tools. Co-ordinate system and reference planes. of HP, VP, RPP & LPP. of 2D/3D environment. Selection of drawing size and scale. Commands and creation of Lines, Co-ordinate points, axes, poly-lines, square, rectangle, polygons, splines, circles, ellipse, text, move, copy, off-set, mirror, rotate, trim, extend, break, chamfer, fillet, curves, constraints viz. tangency, parallelism, inclination and perpendicularity. Dimensioning, line conventions, material conventions and lettering. | |
| ***Module 6: Annotations, layering & other functions*** | **Hrs.**<br>**T-3, P-12** |
| Applying dimensions to objects, applying annotations to drawings; Setting up and use of Layers, layers to create drawings, Create, edit and use customized layers; Changing line lengths through modifying existing lines (extend/lengthen); Printing documents to paper using the print command; orthographic projection techniques; Drawing sectional views of composite right regular geometric solids and project the true shape of the sectioned surface; Drawing annotation, Computer-aided design (CAD) software modeling of parts and assemblies. Parametric and non-parametric solid, surface, and wireframe models. Part editing and two dimensional documentation of models. Planar projection theory, including sketching of perspective, isometric, multiview, auxiliary, and section views. Spatial visualization | |

| | |
|---|---|
| exercises. Dimensioning guidelines, tolerancing techniques; dimensioning and scale multi views of dwelling; | |

**Module wise Measurable Students Learning Outcomes :**
**After the completion of the course the student should be able to:**

- Explain engineering drawing and its place in society
  Demonstrate visual aspects of engineering design
- Explain, and apply engineering graphics projection of standard solid primitives
- Demonstrate visualization of 3-D solid modeling
- Demonstrate computer-aided geometric drafting
- Explain and apply working drawings

| Title of the Course: Biology For Engineers 4BS101 | L | T | P | Cr |
|---|---|---|---|---|
| | 2 | 0 | 0 | 2 |

**Pre Requisite: Nil**

**Textbooks:**

1. P. S. Verma and V. K. Agarwal, Concept of Cell Biology, S. Chand and Company Ltd, 2002.
2. R. D. Vidyarthi and P. N. Pandey, A Text book of Zoology, S. Chand and Company Ltd, 2004.
3. T. S. Ranganathan, Text book of Human Anatomy, S. Chand and Company Ltd, 2002.

**References:**

1. Peter H. Raven, George B. Johnson, Biology, McGraw hill, $11^{th}$ edition, 2017.
2. Engelbert Buxbaum, Fundamentals of Protein Structure and Function, Springer, 2007.
3. Surinder Kumar, Essentials of Microbiology, Jaypee Brothers Medical Publishers (P) Ltd, 2016.
4. Laurence A. Cole, Biology of Life - Biochemistry, Physiology and Philosophy, Elsevier, 2016.
5. V. Sreekrishna, Comprehensive Biotechnology I - Cell Biology and Genetics, New Age, 2005.

**Course Objectives:**

1. Provide a foundation in basic biological principles.
2. Develop an understanding of the modern biological concepts and their applications to engineering and life.
3. Describe the stages of biological evolution on Earth and the interrelation ships among the living organims.

**Course Learning Outcomes:**

| CO | After the completion of the course the student should be able to | Bloom's Cognitive | |
|---|---|---|---|
| | | level | Descriptor |
| CO 1 | Identify the characteristics and basic needs of living organisms and explain the mechanisms of evolution in living organisms. | II | Understanding |
| CO 2 | Outline the structure of the biomolecules and describe the structure and function of cells including the metabolic reactions that occur in cells. | II | Understanding |
| CO 3 | Describe the chromosome theory, molecular genetics as well as identify microorganisms and their role in various environments. | II | Understanding |

**CO-PO Mapping:**

**Computer Science and Engineering**

| | a | b | c | d | e | f | g | h | i | j | k | l |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | | | | | | **1** | | | | | | |
| **CO2** | | | | | | 1 | | | | | | |
| **CO3** | | | | | | 1 | | | | | | |

**Assessments:**
**Teacher Assessment:**
Two components of In-Semester Evaluation (ISE), One Mid-Semester Examination (MSE) and one End-Semester Examination (ESE) having 20%, 30% and 50% weights respectively.

| Assessment | Marks |
|---|---|
| ISE 1 | 10 |
| MSE | 30 |
| ISE 2 | 10 |
| ESE | 50 |

**ISE 1** and **ISE 2** are based on assignment/declared test/quiz/seminar etc.
**MSE**: Assessment is based on 50% of course content (Normally first three modules)
**ESE**: Assessment is based on 100% course content with60-70% weightage for course content (normally three modules) covered after MSE.

**Course Contents:**

| **Module 1 : Introduction and Classification** | **Hı** |
|---|---|
| **Introduction**: History and Significance of Biology.<br>**Evolution**: Origin of life; Biological evolution.<br>**Five kingdom classification**; Need for classification, Salient features and classification of Monera, Protista, Fungi, Plantae and Animalia, Lichens, Viruses and Viroids. | **0** |
| **Module 2 : Molecular Biology** | **Hı** |
| **Cell theory and cell as the basic unit of life**: Structure of Prokaryotic (Typical Bacterial Cell) and Eukaryotic cell (Plant cell and animal cell)<br>**Cell organelles**: Structure and function of endoplasmic reticulum, Golgi bodies, lysosomes, vacuoles; mitochondria, ribosomes, plastids, micro bodies; Cytoskeleton, cilia, flagella, centrioles (ultra structure and function). Nucleus: nuclear membrane, chromatin, nucleolus.<br>**Cell division**: Cell cycle, mitosis, meiosis and their significance. | **0** |
| **Module 3 : Genetics** | **Hı** |
| **Introduction**: Chromosomes, DNA, RNA, Genes, Genetics, Transcription and Translation in prokaryotic and eukaryotic cell<br>**Inheritance**: Mechanisms of inheritance, Unifactorial Inheritance, Multifactorial inheritance,<br>Sex-linked Inheritance. | **0** |
| **Module 4 : Macromolecular Analysis and Protein Structure** | **Hı** |
| **Biomolecules**: Structure and function of proteins (primary secondary, tertiary and quaternary structure), carbohydrates, lipid, nucleic acids;<br>**Enzymes**: Types, properties, enzyme action: - Lock and Key hypothesis, Induced fit hypothesis. | **0** |
| **Module 5 :Bioenergetics and Metabolism** | **Hı** |
| **Bioenergetics:** Thermodynamics –First law of thermodynamics, second law of thermodynamics, Gibbs free energy, endergonic & exergonic reactions,<br>**ATP:** Structure, properties and energy currency of the cell.<br>**Introduction to Metabolism** - Catabolism, anabolism, catabolic, anabolic and amphibolic pathways<br>**Carbohydrate Metabolism:** Introduction, Aerobic and anaerobic pathways: Glycolysis and its regulation, Gluconeogenesis and its regulation. TCA cycle, amphibolic & anaplerotic reactions, production of ATP, Photosynthesis – 'light' and 'dark' reactions: C4-pathway.<br>**Lipid Metabolism:** Beta – oxidations of saturated & unsaturated fatty acids. Ketone bodies, Biosynthesis of fatty acids – Acetyl-CoA carboxylase reaction, Fatty acid synthase complex, Regulation of fatty acid biosynthesis. Biosynthesis of cholesterol.<br>**Amino Acid Metabolism:** Biodegradation of amino acids – deamination, transamination, decarboxylation, urea cycle including its regulation. Biosynthesis of amino acids, Disorders of amino acid metabolism. | **0** |
| **Module 6 : Microbiology** | **Hı** |
| Introduction , Concept of single celled organisms, Concept of species and strains, Identification and Classification of microorganisms, Microscopy, Ecological aspects of single celled organisms, Sterilization and media compositions. | **0** |

**Module Wise Measurable Students Learning Outcomes:**

| **Module 1 : Introduction and Classification** |
|---|
| Identify and describe levels of organization and related functions in plants and animals, their characteristics and basic needs. Explain the classification and the stages of biological evolution on Earth and the interrelation ships among the living organims and development process in individuals and populations. |

| |
|---|
| **Module 2 : Molecular Biology** |
| Describe the structure and function of eukaryotic and prokaryotic cells and explain the structure and function of endoplasmic reticulum, Golgi bodies, lysosomes, vacuoles; mitochondria, ribosomes, plastids, micro bodies; Cytoskeleton, cilia, flagella, centrioles (ultrastructure and function). Nucleus: nuclear membrane, chromatin, nucleolus. including the metabolic reactions that occur in cells. And discuss the process of cell division in both somatic and germ cells. |
| **Module 3 : Genetics** |
| Outline and explain the chromosome theory, molecular genetics and quantitative and evolutionary genetics. Discuss the function, replication and evolution of genomes. Describe Transcription and Translation in prokaryotic and eukaryotic cell Explain the process of inheritance. |
| **Module 4 : Macromolecular Analysis and Protein Structure** |
| Identify the structure of the biomolecules found in all living organisms. Describe how RNA, DNA and proteins are synthesized and describe the types and properties of enzymes and enzyme action. |
| **Module 5 :Bioenergetics and Metabolism** |
| Explain the fundamental energetics of biochemical processes and the chemical logic of metabolic pathway Recognize the basic mechanisms of pathway regulation. Discuss the processes of metabolic transformation the molecular level. |
| **Module 6 : Microbiology** |
| Describe cellular, biochemical, and physiological aspects of microorganisms Explain cellular and biochemical processes involved in pathogenesis (human-pathogen interactions).Identify microorganisms and their role in various environments. Describe the cultural use of microorganisms in food production, medicine, fuel production, and waste treatment. |

| Title of the Course: Material Science 4BS102 | L | T | P | Cr |
|---|---|---|---|---|
| | 2 | 0 | 0 | 2 |

**Pre-Requisite Courses: 12th Std Basic science courses**

**Textbooks:**

1. William D. Callister, "*Fundamentals of Materials Science and Engineering",* Wiley India Pvt. Ltd, 7th Edition, 2009.
2. V.Raghavan, "*Materials Science and Engineering*", PHI Publication, 6th Edition, 2015.
3. U.C.Jindal, "*Material Science and Metallurgy*", Pearson India, 1st Edition, 2012.

**References:**

1. Van Vlack, lawrence H.,"*Elements of Material Science and Engineering*", Pearson India, 6th Edition, 2002.
2. Dr. Donald R. Askeland, "*Essentials of Materials Science & Engineering*", Cengage Learning Publisher, SI Edition, 3rd Edition 2013.

**Course Objectives** :

1. To explain the Mechanical, Magnetic and Thermal properties of Materials.
2. To introduce applications of Metals, Polymers, Ceramics, Composites and Advanced materials.
3. To impart the awareness about role of Materials in Human Evaluation and Industrial Evaluation.

**Course Learning Outcomes:**

| CO | After the completion of the course the student should be able to | Bloom's Cognitive | |
|---|---|---|---|
| | | level | Descriptor |
| **CO1** | Summarize various mechanical properties of materials used in engineering practices. | II | **Understanding** |
| **CO2** | Compare applications of advanced in materials by considering their properties. | II | **Understanding** |
| **CO3** | Discuss social issues, environmental issues and recycling practices related to materials. | II | **Understanding** |

**CO-PO Mapping : Computer Science and Engineering**

| | **a** | **b** | **c** | **d** | **e** | **f** | **g** | **h** | **i** | **j** | **k** | **l** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | | | | | | | **1** | | | | | |
| **CO2** | | | | | | | **1** | | | | | |
| **CO3** | | | | | | | **1** | | | | | |

**Assessment:** Two components of In Semester Evaluation (ISE), One Mid Semester Examination (MSE) and one End Semester Examination (ESE) having 20%, 30% and 50% weightage respectively.

| Assessment | Marks |
|---|---|
| ISE 1 | 10 |
| MSE | 30 |
| ISE 2 | 10 |
| ESE | 50 |

ISE 1 and ISE 2 are based on assignment, oral, seminar, test (surprise/declared/quiz), and group discussion.[One assessment tool per ISE. The assessment tool used for ISE 1 shall not be used for ISE 2]
MSE: Assessment is based on 50% of course content (Normally first three modules)
ESE: Assessment is based on 100% course content with70-80% weightage for course content (normally last three modules) covered after MSE.

**Course Contents:**

| | |
|---|---|
| **Module 1: Introduction**<br>Historical perspective of Materials Science. Why study properties of materials? Classification of materials. Miller indices. Crystallography and Structure of Metals , Unit cell, Crystal systems, Bravais lattice, Miller indices for directions and planes, Close-packed planes and directions, Packing efficiency, Interstitial voids, Hume-Rothery rules, Role of X-ray diffraction in determining crystal structures**.** | **6 Hrs.** |
| | |
| **Module 2: Mechanical Properties of Metals**<br>Elastic deformation. Plastic deformation. Interpretation of tensile stress-strain curves Yielding under multiaxial stress. Fracture. Ductile and brittle fracture, Yield criteria and macroscopic aspects of plastic deformation. | **6 Hrs.** |
| | |
| **Module 3: Applications of Polymers and Composites**<br>Types of polymers, Plastics, Special purpose plastics. Particle reinforced composites. Fiber reinforced composites. Structural composites | **4 Hrs.** |
| | |
| **Module 4: Thermal and Magnetic Properties of Materials**<br>Heat capacity. Thermal expansion. Thermal conductivity. Thermal stresses. Diamagnetism and paramagnetism. Ferromagnetism.Antiferromagnetism and ferrimagnetism. Influence of temperature on magnetic behavior. Domains and Hysteresis, Superconducting materials. | **4 Hrs.** |
| | |
| **Module 5: Advanced Materials**<br>1.Smart Materials-Introduction, Classification, Types, Applications.<br>2. Bio Materials- Introduction, Classification, Types, Applications.<br>3. Materials for sports- Introduction, Classification, Types, Applications.<br>4. Meta materials- Introduction, Classification, Types, Applications. | **4 Hrs.** |
| | |
| **Module 6: Economic, Environmental and Social Issues in Material Science and Engineering**<br>Economic considerations. Environmental and societal considerations. Recycling issues. Life cycle analysis and its use in design. | **3 Hrs.** |
| | |

**Module wise Measurable Students Learning Outcomes :**
**After the completion of the course the student should be able to**

1. Describe different classes of materials and its classification methods.
2. Follow the influence of different mechanical properties in materials selection process for design considerations.
3. Summarize applications of Composites, Ceramics and Polymers.
4. Summarize thermal and magnetic properties of materials.
5. Describe role of advanced materials in future technology development.
6. Follow newer environmental friendly technology for recycling of materials.

| **Title of the Course: Introduction To Geoscience 4BS103** | L | T | P | Cr |
|---|---|---|---|---|
| | 2 | ----- | ----- | 2 |
| **Pre-Requisite Courses: -----** | | | | |

**Textbooks:**

1. Subinoy Gangopadhyay, 'Engineering Geology', Oxford University Press; Pap/Psc edition (March 18, 2013)
2. K. M. Bangar.,"Principles of Engineering Geology", Standard Publishers Distributors 1705-B Nai Sarak, Delhi, edition 2016
3. N. Chenna Kesavulu ,"Textbook of Engineering Geology",Macmillian India Ltd. 2/10 Ansari Road Daryanganj, New Delhi. Edition 2013
4. Parbin Singh,"Engineering and General Geology", , S. K. Katariya and Sons, Delhi.,2013

**References:**


1. A. Holmes, "Principles of Physical Gelogoy", ELBS Chapman and Hall, London.Edition Dec.2016.
2. Dr. D. V. Reddy, "Engineering Geology", Vikas Publishing; Second edition ,2017.
3. M. S. Krishnan, Geology of India and Burma, CBS Publishers & Distributers ,6th Edition December 2009
4. D. N. Wadia, "Geology of India', Forgotten Books Publisher, April 2018
5. Mead L. Jensen and Alan M. Bateman, "Economic Mineral Deposits", John Wiley & Sons; Revised 3rd Edition edition ,11 March 1981.
6. P.C. Jain & M.S. Anantharaman, "Palaeontology", Vishal Publishing co., 2016
7. Umeshwar Prasad, "Economic Geology" CBS Publishers , 2nd edition, 2010.
8. A. I. Levorsen,"Geology of Petroleum" , CBS Publisher, 2nd Edition, 2006
9. U. Ashwathnarayana,"Principles of Nuclear Geology", Routledge; 1 edition , 1985
10. Read, H. H.," Rutley's Elements of Mineralogy" Springer Netherlands, 2012
11. Tyrell, G. W., "Principles of Petrology" Aitbs Publishers And Distributors (2012)
12. M. Ramakrishnan and R. Vaidyanathan, "Geology of India Vol.-I&II" Geological society of India, Bangalore, 2010.


**Course Objectives :**

1. Introduce students the necessary knowledge and concepts in the field of geology and to recognize the synchronism between Geology and other branches of science.
2. Introduce the technique of recognizing and describing various geological features.
3. Enable students to illustrate and interpret geological phenomenon before its consideration in the

field of engineering.

**Course Learning Outcomes:**

| CO | After the completion of the course the student should be able to | Bloom's Cognitive | |
|---|---|---|---|
| | | level | Descriptor |
| **CO1** | Recognize and describe the gross knowledge about the Earth and explain the geotectonic phenomenon. | II | Understanding |
| **CO2** | Summarize different geological phenomenon and also know minerals/rocks and the usages of different ores. | II | Understanding |
| **CO3** | Discuss the stratigraphy of geological formation and understand the lithological conditions and its importance. | II | Understanding |

**CO-PO Mapping:**
**Computer Science and Engineering**

| | a | b | c | d | e | f | g | h | i | j | k | l |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | | | | | | | 1 | | | | | |
| **CO2** | | | | | | | 1 | | | | | |
| **CO3** | | | | | | | 1 | | | | | |

**Assessments :**
**Teacher Assessment:**
Two components of In Semester Evaluation (ISE), One Mid Semester Examination (MSE) and one End Semester Examination (ESE) having 20%, 30% and 50% weights respectively.

| Assessment | Marks |
|---|---|
| ISE 1 | 10 |
| MSE | 30 |
| ISE 2 | 10 |
| ESE | 50 |

ISE 1 and ISE 2 are based on assignment/declared test/quiz/seminar etc.
MSE: Assessment is based on 50% of course content (Normally first three modules)
ESE: Assessment is based on 100% course content with 70-80% weightage for course content (normally last three modules) covered after MSE.

**Course Contents:**

| | |
|---|---|
| **Module 1: Geology and Geotectonics:** Geology, branches of geology and its relation with other sciences. Origin of the Earth, Earth as a member of solar system. Gross features of the Earth. Brief idea about interior of the earth, core, mantle, crust. Concept and theory of Isostacy, continental drift and plate tectonics.orogeny and epirogeny, types of mountains. | **5 Hrs.** |
| | |
| **Module 2: Mineralogy and Petrology:** Introduction to Mineralogy, definition of mineral, common rock forming minerals viz. quartz, feldspars, olivine, augite, hornblende, mica, calcite. Introduction to petrology. Study of igneous, sedimentary and metamorphic rocks. Common rocks viz. granite, gabbro, rhyolite, basalt, shales and sandstone, limestone and laterite, schist, gneiss, marble and quartzite. | **5 Hrs.** |
| | |
| **Module 3: Structural Geology and Palaeontology**: Earthquakes and volcanoes. Introduction to geological structures viz. faults, folds, joints. Introduction to palaeontology, Definition and scope of Palaeontology. Processes of fossilization.,Application of paleontological data in economic geology, palaeoecology, evolution, stratigraphy. | **5 Hrs.** |
| | |
| **Module 4: Economic Geology(Metals):** Introduction to economic geology, Definition of ore, ore minerals and gangue minerals, grades of ores and non-metallic minerals, assay value and tenor of ore. Broad outline of ideas regarding classification of mineral deposits. Uses, geological occurrences, origin and geographical distribution of the ore mineral deposits viz. Iron, Lead, Zinc, Gold, Aluminum, Radioactive minerals, | **5 Hrs.** |
| | |
| **Module 5: Economic Geology(Non-metals):** Uses, geological occurrences, origin and geographical distribution of Non-metals ( related to refractory, fertilizers, cement, chemical, gemstone and electronic industry ) like- Asbestos, Barytes, Gypsum, Mica, Graphite, Talc, Magnesite, Kyanite, Sillimanite, Monazite, Pyrite and Diamond and Rare earth (RE) elements. Fossil fuel (oil and natural gas). | **3 Hrs.** |
| | |
| **Module 6 : Introduction to Indian Stratigraphy:** Physiographic divisions of India and their characteristics, Rivers and mountains of India, Principles of stratigrphy, Geological time scale. Introduction to Vindhyan Supergroup, Gondwana Supergroup and Deccan Trap systems with respect to classification, geologic and geographic distribution, lithological characteristics, fossil content and economic importance. | **5 Hrs.** |

**Module wise Measurable Students Learning Outcomes :**
**After the completion of the course the student should be able to:**
After the completion of the course the student should be able to:
1. perceive and describe the gross knowledge of the Earth and Geotectonics.
2. describe the minerals and rocks with sense of mineralogy and petrology.
3. summarize the phenomenon in physical geology and explain the concepts of palaeontology.
4.describe and sense the knowledge of geology for economic purpose.
5.describe and sense the knowledge of of non-metallic minerals for economic purpose.
6.discuss the concepts of Indian Stratigraphy.

| **Title of the Course: Life Science 4BS104** | **L** | **T** | **P** | **Cr** |
|---|---|---|---|---|
| | **2** | **0** | **0** | **2** |

**Pre requisite: NA**

**Textbooks:**

1. T. S. Ranganathan, Text book of Human Anatomy, S. Chand and Company Ltd, 2002.
2. P. S. Verma and V. K. Agarwal, Concept of Cell Biology, S. Chand and Company Ltd, 2002.
3. R. D. Vidyarthi and P. N. Pandey, A Text book of Zoology, S. Chand and Company Ltd, 2004.

**Reference Books:**

1. Bruce Alberts and Alexander Johnson, Molecular Biology of the Cell Garland Science, Taylor & Francis Group, 6th Edition, 2015.
2. Peter H. Raven, George B. Johnson, Biology, McGraw hill, 11$^{th}$ edition, 2017.
3. Laurence A. Cole, Biology of Life - Biochemistry, Physiology and Philosophy, Elsevier, 2016.
4. V. Sreekrishna, Comprehensive Biotechnology I - Cell Biology and Genetics, New Age, 2005.

**Course Objectives:**

1. Introduce students to modern aspect of life science.
2. Develop an understanding if scientific methods with a broad background in the life sciences at all levels of biological organization (from molecular, cellular, and organismal biology, to populations, communities and ecosystems)
3. Provide a foundation of basic biological principles aned education in life science technologies.

**Course Learning Outcomes:**

| **CO** | **After the completion of the course the student should be able to** | **Bloom's Cognitive** | |
|---|---|---|---|
| | | **level** | **Descriptor** |
| **CO 1** | Outline and describe cytological, biochemical, physiological and genetic aspects of the cell, | II | Understanding |
| **CO 2** | Explain the structure and function of organ systems in the human body and describe the concept, practice and significance of immunity. | II | Understanding |
| **CO 3** | Relate knowledge of Bio chemistry, Biotechnology and Bioinformatics with application areas in Engineering. | II | Understanding |

**CO-PO Mapping :**

**Computer Science and Engineering**

| | **a** | **b** | **c** | **d** | **e** | **f** | **g** | **h** | **i** | **j** | **k** | **l** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | | | | | | | **1** | | | | | |
| **CO2** | | | | | | | **1** | | | | | |
| **CO3** | | | | | | | **1** | | | | | |

**Assessments:**
**Teacher Assessment:**
Two components of In-Semester Evaluation (ISE), One Mid-Semester Examination (MSE) and one End-Semester Examination (ESE) having 20%, 30% and 50% weights respectively.

| Assessment | Marks |
|---|---|
| ISE 1 | 10 |
| MSE | 30 |
| ISE 2 | 10 |
| ESE | 50 |

**ISE 1** and **ISE 2** are based on assignment/declared test/quiz/seminar etc.
**MSE**: Assessment is based on 50% of course content (Normally first three modules)
**ESE**: Assessment is based on 100% course content with60-70% weightage for course content (normally last three modules) covered after MSE.

**Course Contents:**

| Module 1 : Cell Biology | Hrs. |
|---|---|
| Structure and function of prokaryotic (Typical Bacterial Cell) and eukaryotic cell (Plant cell and animal cell) and intracellular organelles, Mechanism of cell division including (mitosis and meiosis) and cell differentiation; Cell-cell interaction. | **03** |
| **Module 2 : Bio Chemistry** | **Hrs.** |
| Structure of atoms, molecules and chemical bonds, Principles of physical chemistry, Thermodynamics, kinetics, dissociation and association constants, Nucleic acid structure, genetic code, replication, transcription and translation in prokaryotic and eukaryotic cell, Structure, function and metabolism of carbohydrates, lipids and proteins, Enzymes and coenzyme. | **04** |
| **Module 3 : Human Physiology** | **Hrs.** |
| a. Digestive system - Digestion, absorption, energy balance<br>b. Respiratory system: Comparison of respiration in different species, anatomical considerations, transport of gases, exchange of gases, waste elimination, neural and chemical regulation of respiration.<br>c. Neural system: Neurons, action potential, gross neuroanatomy of the brain and spinal cord, central and peripheral nervous system, neural control of muscle tone and posture.<br>d. Excretory system: Comparative physiology of excretion, kidney, urine formation, urine concentration, waste elimination, micturition, regulation of water balance, blood volume, blood pressure, electrolyte balance, acid-base balance.<br>e. Cardiovascular System: Comparative anatomy of heart structure, myogenic heart, specialized tissue, ECG – its principle and significance, cardiac cycle, heart as a pump, blood pressure,<br>f. Endocrinology and reproduction - Endocrine glands, basic mechanism of hormone action, hormones and diseases; reproductive processes, gametogenesis, ovulation, neuroendocrine regulation | **09** |
| **Module 4 : Immunity** | **Hrs.** |
| **Antigen and Antibody:** Introduction, definition and types of Antigens, Structure and functions of different classes of immunoglobulins, Primary and secondary immune response, Lymphocytes and accessory cells, Humoral and cell mediated immunity, Mechanism of immune response and generation of immunological diversity; Application of immunological techniques. | **04** |
| **Module 5 : Biotechnology And Its Applications** | **Hrs.** |
| Principles and process of Biotechnology: Genetic engineering (Recombinant DNA technology).<br>Application of Biotechnology in health and agriculture: Production of secondary metabolites/product Insulin, growth hormones: Indol acetic acid, interferons. Methods of gene transfer in plants, improvement. Introduction to trangenics**:** gene therapy, Genetically modified organisms<br>Biosafety issues– Bio piracy. | **04** |
| **Module 6 : Bioinformatics and its Applications** | **Hrs.** |
| Introduction and Definition of Bioinformatics, Molecular Bio informatics: Genomics, Proteomics and Drug Design. Organic and Community Bioinformatics: Bioinformatics of species diversity.<br>Applications of Bioinformatics: Human health, Microbial genome application, Biotechnology, Agriculture, Comparative studies**.** | **04** |

**Module wise measurable students learning outcomes**

**Module 1 : Cell Biology**

Describe the intricate relationship between various cellular structures and their corresponding functions. Explain the cytological, biochemical, physiological and genetic aspects of the cell, including cellular processes common to all cells, to all eukaryotic, prokaryotic cells as well as processes in certain specialized cells. Relate normal cellular structures to their functions.

**Module 2 : Bio Chemistry**

| |
|---|
| Outline structure of atoms, molecules and chemical bonds. Describe principles of physical chemistry, thermodynamics and kinetics. Explain the structure, function and metabolism of carbohydrates, lipids and proteins, Enzymes and coenzyme. |
| **Module 3 : Human Physiology** |
| Outline and describe structure and function of major organ systems in the human body, the neural system and explain the transmission of signals in excitable cells. |
| **Module 4 : Immunity** |
| Identify major components of the immune system at organ, cellular and molecular levels and discuss normal functions of these components during immune responses. Elucidate the relationship between major cellular and molecular components of the immune system. Explain adverse functions of these cellular and molecular components during abnormal circumstances. Describe mechanisms of diseases associated with adverse functions of the immune system. |
| **Module 5 : Biotechnology And Its Applications** |
| Explain the theory and practice of recombinant DNA technology. Describe biocatalysis, pathway engineering, bioprocess control and downstream processing and Identify the applications of Biotechnology. |
| **Module 6 : Bioinformatics and its Applications** |
| Outline the flow and regulation of biological information. Explain the techniques used to collect sequence and expression data. Identify appropriate biological data bases for specific analyses and describe the applications of Bioinformatics |

| Title of the Course: Engineering Chemistry Laboratory : 4CH151 | L | T | P | Cr |
|---|---|---|---|---|
| | 0 | 0 | 2 | 1 |

**Pre-Requisite Courses: : Chemistry course at secondary and higher secondary level**

**References:**

1. Engineering Chemistry Laboratory Manual, Department of Chemistry WCE, Sangli.
2. J Mendham, R.C. Denney, J.D. Barnes, M.J.K Thomas, "Quantitative Chemical analysis", Vogels, Pearson Education, 2008, 6$^{th}$Edition.

**Course Objectives :**

1. To make the student familiar with analytical techniques.
2. To provide hands on practice of titrimetric analysis.

**Course Learning Outcomes:**

| **CO** | **After the completion of the course the student should be able to** | Bloom's Cognitive | |
|---|---|---|---|
| | | level | Descriptor |
| **CO1** | **Apply** principles of volumetry to quantitative analysis of water quality parameter, metal and alloys. **Demonstrate** use of instrument for quantitative analysis. **Experiment** physical/Chemical characteristics of material | III | Applying |
| | | | |
| | | | |

**CO-PO Mapping :**
**Computer Science and Engineering :**

| | **a** | **b** | **c** | **d** | **e** | **f** | **g** | **h** | **i** | **j** | **k** |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | | | | | **1** | | | | | | |

**Assessments :** In Semester Evaluation (ISE)

| Assessment | Marks |
|---|---|
| ISE | 100 |

On the basis of each experiment performed during regular laboratory session, quiz and performance of experiment.

**Course Contents:**

| **List of experiments (Minimum 09)** | **2 Hrs each** |
|---|---|
| 1. Estimation of hardness of water by EDTA method (Complexometric Titration).<br>2. Estimation of alkalinity of water (Neutralization Titration).<br>3. Estimation of Dissolved Oxygen in water (Iodometric Titration).<br>4. Estimation of Chloride content in water (Argentometry).<br>5. Demonstration of pH meter & pH metric titration.<br>6. Determination of strength of acid/base conductometrically. | |

7. Colorimetric estimation of Copper.
8. Estimation of copper from Bronze. (Iodometric Titration).
9. Estimation of Zn from Brass (Displacement Titration).
10. Determination of purity of Iron (Redox Titration).
11. Determination of viscosity of given liquid. By Ostwald viscometer.
12. Determination of corrosion rate by weight loss method
13. Gravimetric estimation of Ba from $BaSO_4$ as BaO.

| **Title of the Course: Civil and Mechanics Laboratory 4CV151** | L | T | P | Cr |
|---|---|---|---|---|
| | -- | -- | 2 | 1 |

**Pre-Requisite Courses:** Basic Civil Engineering and Engineering Mechanics

**References:**

1. Duggal S.K., "Surveying (Vol I)", Tata McGraw Hill, 4th edition 2013
2. Bhavikatti., S. S. and Rajashekarappa., K. G. "Engineering Mechanics", New Age International Publishers,5th Edition,2015.
3. Khurmi. R. S., "Textbook of Applied Mechanics", Tata McGraw Hill Publishing Company, 20th Revised Edition, 2013.

**Course Objectives :**

1. To impart necessary skills to conduct the experiments in surveying using conventional and modern instruments and engineering mechanics.
2. To provide knowledge for conducting experiments to verify the principles of engineering mechanics.

**Course Learning Outcomes:**

| CO | After the completion of the course the student should be able to | Bloom's Cognitive | |
|---|---|---|---|
| | | level | Descriptor |
| CO1 | **Demonstrate** the use of instruments for the measurement of distance, angle and levels. | III | Applying |
| CO2 | **Demonstrate** the verification of laws of mechanics experimentally, analytically and graphically. | III | Applying |

**CO-PO Mapping :**

**CO-PO Mapping with regards to B.Tech Computer Science Engineering Programme:**

| PO | a | b | c | d | e | f | g | h | i | j | k |
|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | | | | | | | | | 1 | | |
| CO2 | | | | | | | | | 1 | 1 | 1 |

**Assessments :**

**Teacher Assessment:**

In Semester Evaluation (ISE)

| Assessment | Marks |
|---|---|
| ISE | 100 |
| ISE is based on experimental work/performance in laboratory/assignment/declared test/etc. | |

**Course Contents:**

**List of Exercises in Civil Engineering**

1. Direct and Indirect Ranging (Line Ranger), Measurement of Horizontal Distances by using chain and Tape,
2. Chain Survey, Setting of offsets by using open cross staff, French cross staff, and Indian optical Square.
3. Chain and Compass Traversing.
4. Study of Digital Planimeter.
5. Study of Dumpy Level and determinationreduced levels.
6. Introduction to Modern Instruments.

**List of Exercise in Engineering Mechanics:**

1. Verification of Law of triangle of forces.
2. Verification of law of polygon of forces.
3. **Determination of support reactions of simply supported beam.**
4. **Verification of the law of moments using Bell crank lever/Efficiency of Bell crank lever**.
5. Graphical solution for concurrent and non-concurrent coplanar force system.

**List of Drawings and Reports:**

1. Preparation of Half Imperial Drawing Sheet showing types of lines, symbols of Doors-windows, building materials, North line etc. according to IS 962.
2. Preparation of Half Imperial Drawing Sheet showing line plan of a single storey Building.

**Module wise Measurable Students Learning Outcomes :**

| **Title of the Course: Workshop Practice 4ME152** | L | T | P | Cr |
|---|---|---|---|---|
| | **0** | **0** | **02** | **01** |

**Pre-Requisite Courses:**

**Textbooks:**

1. Raghuwanshi B. S.,"*A Course in Workshop Technology I",*Dhanapat Rai Publications, 10th Ed.2009

2. S. K. Hajra Choudhury and A. K. Hajra Choudhary,*"Workshop Technology" – Vol I [Manufacturing Processes]",* , Media Promoters and Publishers Pvt. Ltd., 10th edition, reprint 2001

**References:**

1. W.A.J. Chapman, *"Workshop Technology Volume I"*, CBS Publishing & Distributors, Delhi. [ISBN-13:9788123904016] 2001
2. Rao P.N., "Manufacturing Technology", Vol. I and Vol. II, Tata McGrawHill House,2017.

**Course Objectives :**

1. To train the students to use different tools and equipments involved in the manufacturing processes.
2. To develop the skills to handle the basic machine tools and equipments required for various manufacturing processes.
3. To prepare the students to carry out the various operations to make a finished product.
4. Train the students for making PCB for electronic applications.

**Course Learning Outcomes:**

| **CO** | **After the completion of the course the student should be able t** | Bloom's Cognitive | |
|---|---|---|---|
| | | level | Descriptor |
| **CO1** | Describe the methods, operations and processes of manufacturing | II | Understanding |
| **CO2** | Summarize the simple mechanical systems, machines, equipment's, the basic working of cutting tools for manufacturing. | II | Understanding |
| **CO3** | Use of chemical etching technique for making the PCB for electronic applications. | III | Applying |

**CO-PO Mapping :**

**CSE**

| | a | b | C | d | e | f | g | h | i | j | k | l |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | | | | | | | | | **1** | | **1** | |
| **CO2** | | | | | | | | | **1** | | **1** | |
| **CO3** | | | | | | | | | **1** | | **1** | |

**Assessments :Teacher Assessment:**

100% ISE, Continuous assessment based on the experiments, demonstration performed in the lab and followed by oral examination at the end of semester.

| Assessment | Marks |
|---|---|
| ISE | 100 |

**Course Contents:**

1. Composite job based on carpentry, fitting, tin-smithy, welding etc. (16 Hrs.)
2. Composite job of PCB making based on negative film making, UV exposure, development and etching etc. (8 Hrs.)

**Module wise Measurable Students Learning Outcomes : Laboratory Outcomes**

- Upon completion of this laboratory course, students will be able to fabricate components with their own hands.
- They will also get practical knowledge of the dimensional accuracies and dimensional tolerances possible with different manufacturing processes.
- By assembling different components, they will be able to produce small devices of their interest.
- By studying PCB making, students will able to make their own electronic circuits.

| Title of the Course: **Physics for Computer Professionals** 4PH103 | L | T | P | Cr |
|---|---|---|---|---|
| | 3 | - | - | 3 |

**Pre-Requisite Courses:** Students are expected to know the basic concept in Physics.

**Textbooks:** 1. M. N. Avadhanulu and P. G. Kshirsagar, "**A Text book of Engineering Physics** " S.Chand and Company, New Delhi. Revised edition 2014
2. R. K. Gaur and S. L. Gupta "**Engineering Physics**", Dhanpat Rai Publications, New Delhi. Edition: 2011

**References:**

1. Halliday, Resnic and Walker, "**Fundamentals of Physics**", John Wiley, 9th edition 2011.
2. A. Beiser, "**Concepts of Modern Physics**", McGraw Hill International, 5th edition, 2003.
3. Ajoy Ghatak, "**Optics**", Tata McGraw Hill 5th edition, 2012.
4. P. M. Mathews, K. Venkatesan, "**Text Book of Quantum Mechanics**", Tata McGraw Hill 2nd Edition, 2010
5. H. S. Kalsi, "**Electronic Instrumentation**", Tata McGraw Hill, 3rd Edition, 2010.

**Course Objectives:**

1. To provide basic concepts to solve many engineering and technical issues.
2. To give deep insights into the understanding of engineering courses.
3. To encourage them to understand engineering and technical development.

**Course Learning Outcomes:**

| CO | After the completion of the course the student should be able to | Bloom's Cognitive | |
|---|---|---|---|
| | | level | Descriptor |
| CO1 | **Describe** optical phenomenon such as interference, diffraction polarization and in terms of wave model. **Explain** the methods of production and detection methods of ultrasonic waves and its applications. | I | Understanding |
| CO2 | **Explain** Planck's quantum hypothesis, Compton effect, Heisenberg's uncertainty principle, Schrödinger's wave equations and their applications; **Discuss** measurement and errors in measurement**,** **Explain** various display devices, sensors and transducers. | II | Understanding |
| CO3 | **Utilize** fiber optics as a communication channel and **apply** in communication system. **Show** how optical fiber implements as sensor, connectors, couplers and their applications. **Use** the concepts of transducer and sensor, **Classify** transducers, and sensors and their **applications**. | III | Applying |

**CO-PO Mapping:**
**CSE**

| PO | a | b | c | d | e | f | g | h | i | j | k |
|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | | | | | | | | | | 1 |
| CO2 | 2 | | | | | | | | | | 1 |
| CO3 | 2 | | | | | | | | | | 1 |

**Assessments:**

**Teacher Assessment:** Two components of In-Semester Evaluation (ISE), One Mid Semester Examination (MSE) and one End Semester Examination (ESE) having 20%, 30% and 50% weights respectively.

| Assessment | Marks |
|---|---|
| ISE 1 | 10 |
| MSE | 30 |
| ISE 2 | 10 |
| ESE | 50 |

**ISE-1** and **ISE-2** are based on assignment/declared test/quiz/seminar etc.
**MSE:** Assessment is based on 50% of course content (Normally first three modules)
**ESE:** Assessment is based on 100% course content with 70-80% weightage for course content (Normally last three modules) covered after MSE.

**Course Contents:**

| | |
|---|---|
| **Module 1: Optics** | **7Hrs.** |
| Introduction, types of optics, diffraction, types of diffraction, Fresnel's diffraction: Fresnel's half period zones, zone plate, diffraction at straight edge. Fraunhofer's diffraction: diffraction due to single slit, double slits, plane diffraction grating. Polarization: optical activity, specific rotation of optical active substances, Laurent's half shade polarimeter. | |
| **Module 2: Quantum Physics** | **8Hrs.** |
| Introduction, black body radiation, Planck's quantum theory, Wien's displacement law and Rayleigh – Jeans law, phase velocity, group velocity and particle velocity, de-Broglie's hypothesis, Compton effect: theory and experimental verification, Heisenberg's uncertainty principle and its applications, wave function and its physical significance, Schrödinger's wave equation: time independent and time dependent, applications of Schrödinger's wave equation. | |
| **Module 3: Ultrasonics** | **6Hrs.** |
| Introduction, classification of sound, ultrasonic waves, generation of ultrasonic waves (Magnetostriction and Piezoelectric method), detection of ultrasonic waves by Kundt's tube, thermal detection and sensitive flame method, velocity of ultrasonic waves in liquid, applications of ultrasonic waves in scientific and engineering field. | |
| **Module 4: Communication channel** | **6Hrs.** |
| Introduction, types of communication channel, wired: twisted pair, co-axial, and optical fiber, optical fiber: types, acceptance angle and numerical aperture, fiber optics communication, optical fiber sensors, optical fibre connector, optical fiber couplers and application. Wireless channels: terrestrial microwave, satellite microwave. | |
| **Module 5: Measurement and Display Devices** | **7Hrs.** |
| Introduction, Measurement: qualities of measurements, static characteristics, errors in measurement, types of error, statistical analysis. Display devices: LED, LCD, gas discharge plasma | |

| | |
|---|---|
| display, segmented gas discharge display, Segmental display using LED, dot matrix display, bar graph display, electro luminescent display, incandescent display, electrophoretic display, liquid vapor display. | |
| **Module 6: Computer Instrumentation** | **6Hrs.** |
| Introduction, instrumentations, measurement system, control system, Transducer and Sensor: transducers, sensors, classification of transducers, characteristics of transducers, selection criterion for transducers, temperature transducers, strain gauge, pressure transducers, force transducers, optical transducers, actuators. | |

**Module wise Measurable Students Learning Outcomes :**

**After the completion of the course the student should be able to:**

1. Module-1: describe Fresnel’s and Fraunhofer type diffraction, polarization and applications in technological field.
2. Module-2: use the concepts of quantum mechanics and apply for solving the problems.
3. Module-3: acquire the knowledge of ultrasonic waves and implement in various fields.
4. Module-4: explain the types of communication channels and acquire the knowledge of optical fiber for advance communication.
5. Module-5: know the correct measurement of physical quantities and get the knowledge of different display devices.
6. Module-6: distinguish between sensors and transducers, and use in the proper system for controlling the desired physical quantities.

| Title of the Course: Engineering Mathematics II 4MA102 | L | T | P | Cr |
|---|---|---|---|---|
| | **3** | **1** | **-** | **4** |

**Pre-Requisite Courses:**Mathematics course at Higher Secondary Junior College

**Textbooks:**

1. P. N. and J. N. Wartikar, "A Text Book of Applied Mathematics", Vol I and II", Vidyarthi Griha Prakashan, Pune, 2006.
2. B .S. Grewal , "Higher Engineering Mathematics", Khanna Publication, 44th Edition , 2017.
3. S.C. Gupta, "Fundamentals of Mathematical Statistics and probability", Sultan chand &Sons,2014.

**References:**

1. Erwin Kreyszig, "Advanced Engineering Mathematics", Wiley Eastern Limited Publication, 2015, 10th Edition.
2. Wylie C.R, *"Advanced Engineering Mathematics",* Tata McGraw Hill Publication, 8th Edition, 1999.
3. H. K. Dass *, "Higher Engineering Mathematics",* S. Chand & Company Ltd., 1st Edition 2014.

*4* S. S. Sastry, *"Engineering Mathematics (Volume-I)",* Prentice Hall Publication, 3rd Edition 2006.

**Course Objectives :**

Familiarize the students with techniques in multivariate integration and statistics. .

**Course Learning Outcomes:**

| CO | After the completion of the course the student should be able to | Bloom's Cognitive | |
|---|---|---|---|
| | | level | Descriptor |
| **CO1** | Apply computational tools to solve mathematical and statistical problems. | III | Applying |
| **CO2** | Solve problems in probability, statistics and multivariable calculus. | III | Applying |
| | | | |

**CO-PO Mapping :**

**Computer Science and Engineering :**

| | a | b | c | d | e | f | g | h | i | j | k |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | **2** | | | | **1** | | | | | | |
| **CO2** | **2** | | | | **1** | | | | | | |

**Assessments :**

**Teacher Assessment:**

Two components of In Semester Evaluation (ISE), One Mid Semester Examination (MSE) and one End Semester Examination (ESE) having 20%, 30% and 50% weights respectively.

| Assessment | Marks |
|---|---|
| ISE 1 | 10 |
| MSE | 30 |
| ISE 2 | 10 |
| ESE | 50 |

| |
|---|
| ISE 1 and ISE 2 are based on assignment/declared test/quiz/seminar etc.<br>MSE: Assessment is based on 50% of course content (Normally first three modules)<br>ESE: Assessment is based on 100% course content with60-70% weightage for course content (normally last three modules) covered after MSE. |

**Course Contents:**

| | |
|---|---|
| **Module 1: Beta-Gamma Functions:**<br>Definition of Beta, Gamma functions and properties of Beta Gamma functions. | **5Hrs.** |
| **Module 2: Multivariable Calculus:**<br>Multiple Integrals: Double integrals, change of order of integration, change of variables (Cartesian to polar) Evaluation of triple integrals, Application of Multiple integrals such as Area enclosed by plane curves, Mass of lamina, Volume of solid. | **10Hrs.** |
| **Module 3: Numerical Solution of Ordinary Differential Equations of first order and first degree:**<br>Numerical Solution by (i) Picard's Method (ii) Taylor's series method (iii) Euler's method (iv) Modified Euler's method (v) Runge- Kutta fourth order method. | **6Hrs.** |
| **Module 4: Probability theory:**<br>Introduction, Sample Space, Events, Axioms of probability, Conditional probability Baye's Theorem. | **6 Hrs.** |
| **Module 5: Statistics:**<br>Correlation, Linear Regression, Curve-fitting: (a) straight Line (b) parabolic curve (c) exponential curve (d) logarithmic curve. | **6 Hrs.** |
| **Module 6: Probability Distribution:**<br>Random Variable, Binomial distribution, Poisson distribution, Normal distribution. | **7Hrs.** |

**Module wise measurable students learning outcome:**
After the completion of the course the student should be able to

**Module 1: Beta-Gamma Functions:**
Solve complicated integrals with the help of Beta-Gamma functions.
**Module 2: Multivariable Calculus:**
Explain and solve the integral of physical phenomena when it depends on several variables
**Module 3: Numerical Solution of Ordinary Differential Equations of first order and first degree:**
Solve different numerical methods of ordinary differential equation of first order and first degree.
**Module 4: Probability theory:**
Solve various problems in probability theory.
**Module 5: Statistics:**
Fit the curve using given data.
**Module 6: Probability Distribution:**
Solve various problems in probability distribution.

**Tutorial:**
During the tutorial we will ensure that the students have properly learnt the topics covered in the lectures. This shall include assignment , quiz, surprise test or declare test. The teacher may add another activity.

| **Title of the Course: Basic Mechanical Engineering 4ME101** | L | T | P | Cr |
|---|---|---|---|---|
| | 2 | 0 | 0 | 2 |

**Pre-Requisite Courses:**

**Textbooks:**

1. Agarwal, C. M. *"Basic Mechanical Engineering"*, Wiley India Pvt. Ltd., 2014
2. Vasandani V. P. and Kumar D. S., "*Heat Engineering*", Metro Politian Book Company, 2$^{nd}$ Edition, 1975.
3. Hajra Choudhury S. K.,*"Workshop Technology" – Vol II [Machine Tools]",* Media Promoters and Publishers Pvt. Ltd., Tenth edition, reprint 2001

**References:**

1. Nag P. K,. "*Thermodynamics*", Tata McGraw Hill Publication, 3rd Edition, 2006
2. Rajput R.K, *"Thermal Engineering"*, Laxmi Publication 2010.

**Course Objectives :**

Interpret the systems of conventional and non-conventional power plants.

1. Prepare the student to summarize concepts of basic mechanical systems and thermodynamics.
2. Discuss the properties of steam and its behavior with temperature and pressure.
3. Identify the power transmission, bearing and lubrication systems.
4. Introduce different manufacturing processes and machine tools for applications.

**Course Learning Outcomes:**

| **CO** | **After the completion of the course the student should be able to** | Bloom's Cognitive | |
|---|---|---|---|
| | | level | Descriptor |
| **CO1** | Interpret the various terms related to energy generation, mechanical system, thermodynamic systems, manufacturing processes and machines | II | Understanding |
| **CO2** | Describe thermodynamic system, power producing/absorbing/ transmission devices and manufacturing processes/machines. | II | Understanding |
| **CO3** | Distinguish the various energy generation, power transmission, mechanical systems, operations/machines involved in production processes. | II | Understanding |
| **CO4** | Calculate the operating and geometric parameters in thermodynamics and power transmission systems | III | Applying |

**CO-PO Mapping :**

FY B.Tech Computer science and Engineering

| | **a** | **b** | **c** | **d** | **e** | **f** | **g** | **h** | **i** | **j** | **k** | **l** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | **1** | | | **1** | | | | | | | **1** | |
| **CO2** | | | | **1** | **1** | | | | | | **1** | |
| **CO3** | | | | **1** | | | | **1** | | | **1** | |
| **CO4** | | | | **1** | | | | | | | | |

**Assessments :**
**Teacher Assessment:**
Two components of In Semester Evaluation (ISE), One Mid Semester Examination (MSE) and one End Semester Examination (ESE) having 20%, 30% and 50% weights respectively.

| Assessment | Marks |
|---|---|
| ISE 1 | 10 |
| MSE | 30 |
| ISE 2 | 10 |
| ESE | 50 |

ISE 1 and ISE 2 are based on assignment/declared test/quiz/seminar etc.
MSE: Assessment is based on 50% of course content (Normally first three modules)
ESE: Assessment is based on 100% course content with60-70% weightage for course content (normally last three modules) covered after MSE.

**Course Contents:**

| **Module 1: Conventional and Non-Conventional Power Plants** | **5Hrs.** |
|---|---|
| Steam power plant, Hydro power plant, solar thermal power generation system, Four Stroke and Two Stroke Petrol & Diesel Engines. Diesel Power Plant, Wind power plants, Nuclear power plant. | |
| **Module 2: Study of Mechanical systems** | **4 Hrs.** |
| Pumps, Compressors, Refrigeration/Air conditioning system, Hydraulic and Pneumatic systems. | |
| **Module 3: Basic Thermodynamics** | **5Hrs.** |
| First Law & Second Law of Thermodynamics. Gas Processes Carnot Cycle, Otto cycle, Joules Cycle, Air Standard efficiency, Numericals on above. | |
| **Module 4: Properties of steam** | **4Hrs.** |
| Introduction, Steam formation, Different forms of Steam, Enthalpy, Specific volume of steam and dryness fraction of steam, Internal energy. Simple numerical by using Steam Tables. | |
| **Module 5: Power Transmission** | **5Hrs.** |
| Belt drives, Chain drives and gears drives, (Numerical's on belt tensions, gear ratio, and velocity ratio), Couplings and their types. Function of bearings, Basic types of bearings, Lubrication. | |
| **Module 6: Manufacturing Processes** | **5Hrs.** |
| Metal casting processes- (Die casting, Sand casting), Metal forming processes- forging, rolling, extrusion, drawing. Metal cutting operations- turning, drilling, milling, boring, reaming, shaping, gas cutting etc. Metal joining processes- welding, riveting, soldering and brazing. | |

**Module wise Measurable Students Learning Outcomes :**
**Student should be able to**

1. Summarize the Conventional and Non-Conventional Power plants and its functioning.
2. Describe and demonstrate the various mechanical systems.
3. Explain fundamental concepts of thermodynamics from engineering point of view.
4. Obtain and use the properties of steam and other parameters using standard steam tables.
5. Interpret the working of power transmission system, its types and solve some simple numerical related to design.
6. Relate different production processes commonly used in industries.

| Title of the Course: Basic Electrical Engineering 4EL101 | L | T | P | Cr |
|---|---|---|---|---|
| | 2 | -- | -- | 2 |

**Pre-Requisite Courses:**

**Textbooks:**

1. D.C. Kulshreshtha, "Basic Electrical Engineering", 1st revised edition McGraw Hill, 2012.
2. D. P. Kothari and I. J. Nagrath, "Basic Electrical Engineering", Tata McGraw Hill, 2010.

**References:**

1. V. D. Toro, "Electrical Engineering Fundamentals", Prentice Hall India, 1989.
2. E. Hughes, "Electrical and Electronics Technology", Pearson, 2010.
3. V. N. Mittle and Arvind Mittal, "*Basic Electrical Engineering*", 2nd edition TMH, 2006.

**Course Objectives :**

1. This course intends to summarize and solve electrical and magnetic circuits.
2. It imparts skill to identifying principles, construction and working of electrical machines.
3. It develops skill to describe the wiring system, lamps and low voltage installation components.

**Course Learning Outcomes:**

| CO | After the completion of the course the student will be able to | Bloom's Cognitive | |
|---|---|---|---|
| | | level | Descriptor |
| **CO1** | **Explain** principles, construction and working of electrical machines. | 2 | Understanding |
| **CO2** | **Solve** electrical and magnetic circuits. | 3 | Applying |

**CO-PO Mapping:**
**CSE**

| PO | a | b | c | d | e | f | g | h | i | j | k |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | | | | | | | | | | | **1** |
| **CO2** | | | | | | | | | | | **1** |
| **CO3** | | | | | | | | | | | **1** |

**Assessment:**

Two components of In Semester Evaluation (ISE), One Mid Semester Examination (MSE) and one End Semester Examination (ESE) having 20%, 30% and 50% weightage respectively.

| Assessment | Marks |
|---|---|
| ISE 1 | 10 |
| MSE | 30 |
| ISE 2 | 10 |
| ESE | 50 |

ISE 1 and ISE 2 are based on assignment, oral, seminar, test (surprise/declared/quiz), and group

discussion.[One assessment tool per ISE. The assessment tool used for ISE 1 shall not be used for ISE 2]
MSE: Assessment is based on 50% of course content (Normally first three modules)
ESE: Assessment is based on 100% course content with70-80% weightage for course content (normally last three modules) covered after MSE.

**Course Contents:**

| **Module 1: DC Circuits** | **Hrs.** |
|---|---|
| Review of R-L-C- Electrical circuit elements, KCL and KVL. Star- delta conversion, voltage and current sources. Magnetic circuits, equivalence of heat and power. Thevenin, Norton and Superposition Theorems. | **4** |
| **Module 2: AC Circuits** | |
| Representation of sinusoidal waveforms, peak, RMS values, phasor representation real, reactive and apparent power. Analysis of single-phase, ac circuits consisting of R, L, C, RL, RC, RLC (series and parallel) circuits and three-phase balanced circuits. Voltage and current relations in star and delta. | **4** |
| **Module 3: DC Machines** | **Hrs.** |
| Construction, working principle and types of DC generator and Motor. Voltage and speed control methods, Speed-Torque characteristics. Principle, construction, working and application of stepper, servo and universal motors. | **4** |
| **Module 4: Transformers** | **Hrs.** |
| Construction, working principle and types of single-phase transformer, open circuit and short circuit tests: Losses, efficiency, all-day efficiency and regulation. Autotransformer Three-phase transformer construction and connections. | **6** |
| **Module 5: AC Machines** | **Hrs.** |
| Construction and working principle of single and three- phase induction motor. Types, torque- speed characteristics and applications of induction motor, Types of starters, AC generator. | **4** |
| **Module 6: Wiring, Electrical Installations and Components of LT Switchgear** | **Hrs.** |
| Switch fuse unit, MCB, ELCB, MCCB. Types of wire and cables. Staircase, Godown and Domestic wiring, CFL, LED, Fluorescent tube. Lighting schemes, Earthing, types of batteries, characteristics of batteries. | **4** |

**Module wise Measurable Students Learning Outcomes:**

After completion of the course students will be able to:

1. Explain the KVL and KCL to solve electric and magnetic circuit.
2. Explain fundamentals of AC circuit.
3. Describe construction and working of DC machine.
4. Summarize construction and working of single- phase transformer and three- phase transformer.
5. Describe three- phase and single- phase Induction Motor with application.
6. Recognize wiring, illumination, supply system and installation components.

| Course Name: Basic Electronics Engineering 4EN101 | L | T | P | Cr |
|---|---|---|---|---|
| | 2 | 0 | 0 | 2 |

**Pre-Requisite Courses:** 12th Physics

**Textbooks:**
1. R. P. Jain, "Modern Digital Electronics", Tata McGraw Hill, 4th edition 2009
2. A. Anand Kumar, "Fundamentals of Digital Design", PHI, 4th edition 2016
3. Robert Boylestad, Louis Nashelsky, "Electronic Devices and Circuits, Pearson, 11th edition, 2015
4. Ramakant Gaikwad, "Op-amp and Linear Integrated Circuits", Pearson,4th edition,2015

**References:**
1. Morris Mano, "Digital Design", Pearson, 4th edition, 2011
2. Donald A. Neamen, "Electronic Circuit Analysis and Design", Tata McGraw Hill, 3rd edition, 2011
3. Robert F. Coughlin and Frederick F. Driscoll, "Operational amplifiers and linear integrated circuits", PHI, 6th edition, 2009

**Course Objectives:** The aim of this course is to provide knowledge of basic electronics to first year engineering students, so that they can understand, design and implement small digital / analog electronic circuits.

**Course Learning Outcomes:**

| COs | After the completion of the course the student should be able to | Bloom's Cognitive | |
|---|---|---|---|
| | | Level | Descriptor |
| **CO1** | **explain** fundamentals of digital electronics. | *II* | Understanding |
| **CO2** | **use** logic gates, diodes and transistors based circuit. | *III* | Applying |
| **CO3** | **construct** small application circuits using opamp and IC 555. | *III* | Applying |

**CO-PO Mapping:**
**CSE**

| PO | a | b | c | d | e | f | g | h | i | j | k |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | | | | | | | | | | | **1** |
| **CO2** | | | | | | | | | | | **1** |
| **CO3** | | | | | | | | | | | **1** |

**Assessments:**
**Teacher Assessment:**
Two components of In Semester Evaluation (ISE), One Mid Semester Examination (MSE) and one End Semester Examination (ESE) having 20%, 30% and 50% weights respectively.

| Assessment | Marks | Evaluation |
|---|---|---|
| ISE 1 | 10 | Based on assignments/declared tests/quizzes/seminar etc. |
| MSE | 30 | Assessment is based on 50% of course contents. |
| ISE 2 | 10 | Based on assignments/declared tests/quizzes/seminar/ mini-project etc. |
| ESE | 50 | Assessment is based on 100% course contents with 70-80% weightage for course contents covered after MSE. |

| Course Contents: | Hours |
|---|---|
| **Module 1: Fundamentals of Digital Electronics** | |
| Number systems and arithmetic operations, logic gates, Boolean algebra, SOP and POS terms, K-map reduction technique, converting AOI to NAND/NOR logic | 5 |
| **Module 2: Combinational and Sequential Circuits** | |
| Combinational Circuits: half adder and subtractor, 1-bit full adder and subtractor, 1-bit and 2-bit comparator, BCD and gray code, binary to gray code converter, gray to binary code converter, Sequential Circuits: flip-flops, counters. | 5 |
| **Module 3: Semiconductor Diode and its Applications** | |
| PN junction diode, diode characteristics, types of diode, diode as Switch, diode circuits: half-wave and full-wave rectifier, zener diode as voltage regulator, clippers and clampers. | 5 |
| **Module 4: Basics of Transistor** | |
| Transistor structure, types (BJT and FET), transistor configurations, biasing methods, transistor as a switch, BJT amplifier, JFET amplifier, Introduction to MOS transistor. | 5 |
| **Module 5: Operational Amplifier** | |
| Amplifier fundamentals, basic op-amp configuration, op-amp powering, feedback in op-amp circuits, ideal op-amp circuits analysis, inverting, non-inverting amplifier, summing amplifier, difference amplifier, unity gain buffer | 5 |
| **Module 6: IC555** | |
| IC555 timer: Block diagram, construction and working of astable and monostable multivibrator using IC555 | 3 |

**Module wise Measurable Students Learning Outcomes:**
After the completion of the course the student should be able to
Module 1: **explain** fundamentals digital electronics.
Module 2: **use** logic gates based circuits.
Module 3: **illustrate** applications of semiconductor diode.
Module 4: **illustrate** use of transistor as a switch and amplifiers.
Module 5: **construct** op-amp based electronic circuits.
Module 6: **construct** IC 555 based electronic circuits.

| **Title of the Course: English for Professional Communication 4HS101**<br>**Course Code :** | ***L*** | ***T*** | ***P*** | ***Cr*** |
|---|---|---|---|---|
| | **2** | **1** | **0** | **3** |
| **Pre-Requisite Courses:** Higher Secondary Level | | | | |
| **Textbook:** | | | | |

**References:**
**Authors, title of books in Italics, Publisher, Edition, year of Publication**

1. K.R.Laxminarayanan, *English for Technical Communication,* Scitech, Sixth Edition, 2008
2. William Sanborn Pfeiffer ,T.V.S. Padmaja ,*Technical Communication: A Practical Approach,* Pearson, Sixth Edition 2012
3. A.K.Jain, Praveen Bhatia, A.M.Shaikh, *Professional Communication Skills,* S. Chand and Co: Fifth edition ,2009
4. Ashraf Rizvi ,*Effective Technical Communication,* Tata McGraw Hills publishing Company 2006
5. F.T.Wood,Remedial English Grammar, Macmillan, 2007
6. Andrea J.Rutherford,Phd. *Basic Communication Skills for Technology,* Pearson Education Asia,2001
7. Exercises in Spoken English, Parts 1 and II CIEFL, Hyderabad , Oxford University Press
8. Sanjay Kumar, Pushplata , *Communication Skills*, Oxford University Press, First edition ,2012

**Course Objectives :**

- Inculcate the importance of Technical English Communication Skills
- Enhance their communicative competence
- Enable the students to communicate with clarity and precision
- Prepare the students to acquire structure and written expression required for their profession and enable them to acquire proper behavioral skills

**Course Learning Outcomes:**

After completing this course students will be able to:

1. Communicate clearly, precisely and competently in different scenario.
2. Demonstrate the information through oral, written and graphic messages.
3. Acquire basic proficiency in English including reading and listening comprehension, writing and speaking skills.

| CO | After the completion of the course the student should be able to | Bloom's Cognitive | |
|---|---|---|---|
| | | Level | Descriptor |
| CO1 | Communicate clearly, precisely and competently in different scenario | III | Applying |
| CO2 | Demonstrate the information through oral , written and graphic messages | II | Understanding |
| CO3 | Acquire basic proficiency in English including reading and listening comprehension ,writing and speaking skills | III | Applying |

**CO-PO Mapping :**
**CSE**

| PO | a | b | c | d | e | f | g | h | i | j | k |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | | | | | | | | | | 3 | |
| **CO2** | | | | | | | | | | 3 | |
| **CO3** | | | | | | | | | | 3 | |

**Assessments :**
**Teacher Assessment:**

Two components of In Semester Evaluation (ISE), One Mid Semester Examination (MSE) and one End Semester Examination (ESE) having 20%, 30% and 50% weights respectively.

| Assessment | Marks |
|---|---|
| ISE 1 | 10 |
| MSE | 30 |
| ISE 2 | 10 |
| ESE | 50 |

ISE 1 and ISE 2 are based on assignment/declared test/quiz/seminar etc.
MSE: Assessment is based on 50% of course content (Normally first three modules)
ESE: Assessment is based on 100% course content with 70-80% weightage for course content (normally last three modules) covered after MSE.

**Course Contents:**

| | |
|---|---|
| **Module 1: Sentence Structure and Vocabulary Building**<br>1. Subject Verb Agreement<br>2. Modal verbs<br>3. Question tags<br>4. Connectives | **5Hrs.** |

| | |
|---|---|
| 5. Synonyms, Antonyms, and Standard abbreviations<br>6. Redundancies<br>7. Misplaced Modifiers<br>8. Passives | |
| | |
| **Module 2 : Fundamentals of Communication**<br>1. Features and Functions<br>2. Importance of Communication<br>3. The Communication Process<br>4. Barriers and Breakdown of Communication<br>5. Communication in an Organization<br>i. Upward communication<br>ii. Downward communication<br>iii. Horizontal communication<br>iv. Diagonal communication<br>v. Informal communication / Grapevine communication | **3Hrs.** |
| | |
| **Module 3 : Nature and Style of Writing**<br>1. Describing<br>2. Defining<br>3. Classifying<br>4. Providing examples or evidence<br>5. Writing Introduction and Conclusion | **3Hrs.** |
| | |
| **Module 4 :**<br>**A. Non Verbal Communication**<br>1. Kinesics or Body Language<br>2. Proxemics : Space Distance<br>3. Haptic<br>4. Vocalic : Paralinguistic features | **2Hrs.** |

| | |
|---|---|
| i. Pitch<br>ii. Volume<br>iii. Pauses<br>iv. Rate of words/minute<br>5.Chronemics<br>6.Nonverbal Barriers<br><br>**B. Listening Skills**<br>1. Process of Listening<br>2. Types of Listening<br>3. Barriers to effective Listening | **2Hrs** |
| | |
| **Module 5 :**<br>**A. Oral Communication**<br>1. Speeches for different Occasions ( Welcome Speech , Introductory Speech, Vote of Thanks Speech )<br>2. Group Presentations<br>3. Group Discussions<br>4. Individual Presentations<br>5. Job Interviews<br>**B. Basics of Phonetics**<br>1. Improper Pronunciation<br>2. Classification of Sounds in English<br>3. Word Stress<br>4. Sentence Stress or Intonation<br>5. Pronunciation and Articulation | **4Hrs.**<br><br>**1Hr** |
| | |
| **Module 6 : Writing Communication**<br>**A. Basic Writing Skills :**<br>1. Paragraph Writing<br>2. Comprehension<br>3. Essay Writing<br>4. Sentence Structures<br>5. Use of phrases & clauses in sentences<br>6. Importance of proper punctuations<br>7. Creating coherence | **2Hrs**<br><br>**2Hrs** |

| | |
|---|---|
| 8. Organising the principles of paragraphs in documents<br><br>9. Techniques for writing precisely<br><br>**B. Business Correspondence** :<br>1. Job Applications<br>2. Complaint Letters and Adjustment Letters<br>3. Inquiry and Order<br>C. **Official Correspondence :**<br>**1**. Memorandums<br>2. Circulars<br>3. Notices<br>**D .Report Writing** :<br>1. Individual Report<br>2. Lab Report<br>3. Inspection Reports | **2Hrs**<br><br><br><br>**2Hrs** |
| | |

**Module wise Measurable Students Learning Outcomes :**

**Module 1:** Construct different types of sentences
**Module 2:** Communicate effectively and avoid barriers
**Module 3:** Understand the different styles of writing.
**Module 4:** Demonstrate the advantages and limitations of non verbal Communication
**Module 5:** Acquire proficiency in technical English and communicate confidently in different Formal situations.
**Module 6:** Write effective paragraphs, reports, letters and practice written communication effectively.

**After the completion of the course the student should be able to:**

1. Enrich their Vocabulary.
2. Improve their sentence structure.
3. Communicate confidently in different formal situations.

**Tutorial: Computer Usage / Lab Tool :**

Language lab activities are conducted on computers

**Laboratory Experiences:**

1. Listening and reading skills improved
2. Thinking and concentration are developed

**Independent Learning Experiences:**

Students prepare for Seminars, presentations, Group Discussions and also Written Tests confidently.

| Title of the Course: Engineering Physics Laboratory 4PH151 | L | T | P | Cr |
|---|---|---|---|---|
| | - | - | 2 | 1 |

**Pre-Requisite Courses:** Students are expected to know the basic practical knowledge in HSC Level.

**Textbooks:** 1. C. L. Arora "**Practical Physics**" S. Chand & Co Edition 2009.
2. P.R. Sasi Kumar "**Practical Physics**", PHI Learning Pvt.Ltd 1st edition 2011.

**References:**
1. Halliday, Resnic and Walker, "**Fundamentals of Physics**", John Wiley, 9th edition 2011.
2. A. Beiser, "**Concepts of Modern Physics**", McGraw Hill International, 5th edition, 2003.
3. Ajoy Ghatak, "**Optics**", Tata McGraw Hill 5th edition, 2012.

**Course Objectives:**
1. To gain practical knowledge by applying the experimental methods to correlate with the Physics theory.
2. To learn the usage of electrical and optical systems for various measurements.
3. To Apply the analytical techniques and graphical analysis to the experimental data.

**Course Learning Outcomes:**

| CO | After the completion of the course the student should be able to | Bloom's Cognitive | |
|---|---|---|---|
| | | level | Descriptor |
| CO1 | **Calculate** the diameter of the thin wire, wavelength of light, Planck's constant, values of e/m of an electron, Specific rotation of optical active substances. **Demonstrate** Hartley and Colpitt's oscillator with their simulations, Newton's ring, and I-V characteristics of semiconductor diode. Kundt's tube. | III | Applying |

**CO-PO Mapping :**
**Computer Science and Engineering :**

| | a | b | c | d | e | f | g | h | i | j | k |
|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | | | | | 1 | | | | | | |

**Assessments: :** In Semester Evaluation (ISE)

| Assessment | Marks |
|---|---|
| ISE | 100 |
| On the basis of each experiment performed during regular laboratory session, performance of experiment, quiz or oral, and final internal practical examination. | |

**Course Contents:**

| List of Experiments | |
|---|---|
| **List of Experiments** (Minimum 8 experiments from the following list)<br>1. Find the diameter of the thin wire by diffraction of the light<br>2. Determination of wavelength of light by plane diffraction grating.<br>3. Determine the Specific rotation of sugar solution<br>4. Find the wavelength of He-Ne Laser using Plane diffraction grating.<br>5. Find the e/m for the cathode rays<br>6. Verify the expression for the resolving power of a telescope.<br>7. Measure the wavelength of ultrasonic waves by Kundt's tube method.<br>8. Design and simulate Colpitt's & Hartley Oscillator.<br>9. Determine the Planck's constant.<br>10. Find the wavelength and velocity of ultrasonic waves in liquid.<br>11. Study the I-V characteristic of semiconductor diode.<br>12. Newton's ring: Determination of wavelength of light and refractive index of liquid. | **2 Hrs. each Expt.** |

| Title of the Course: Computer Programming 4CS153 | L | T | P | Cr |
|---|---|---|---|---|
| | 0 | - | 4 | 2 |

**Pre-Requisite Courses:** Basic course of software and hardware programming.

**Textbooks:**

1. Byron Gottfried, Schaum's, "Outline of Programming with C", McGraw-Hill, Third edition, 2017.
2. Yashavant Kanetkar, "Let Us C", BPB Publication, Fifteenth edition, 2016.
3. E. Balagurusamy, "Programming in ANSI C", Tata McGraw-Hill Education, Seventh edition, 2016.

**References:**

1. Brian W. Kernighan and Dennis M. Ritchie, "The C Programming Language", Prentice Hall of India, Second Edition, 2015.

**Course Objectives :**

- To develop problem-solving skills to translate text described problems into programs written using the Programming language with the help of language constructs.
- To impart knowledge on general principles of computer languages such as: conditional branching, loops, block structures, functions, and input/output.

**Course Learning Outcomes:**

| CO | After the completion of the course the student should be able to | Bloom's Cognitive | |
|---|---|---|---|
| | | level | Descriptor |
| CO1 | grasp the basics of computer programming | II | Understanding |
| CO2 | implement algorithms and programs | III | Applying |
| CO3 | apply programming to solve simple problems in computer science and engineering | III | Applying |

**CO-PO Mapping :**

**Computer Science and Engineering:**

| PO and PSO | a | b | c | d | e | f | g | h | i | j | k | l | m | n |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | - | - | - | 1 | 1 | - | - | - | - | - | - | - | - | - |
| CO2 | - | 1 | - | 1 | 1 | - | - | - | - | - | - | - | - | - |
| CO3 | - | 2 | - | - | - | - | - | - | - | - | - | - | - | - |

**Assessments :**

**Teacher Assessment:**

In Semester Evaluation (ISE)

| Assessment | Marks |
|---|---|
| ISE | 100 |

| ISE Type | Marks |
|---|---|
| Continuous Assignment and submission | 40 |
| Practical performance and oral | 30 |
| Test (Surprise/ declared/ quiz) | 30 |

ISE is based on performance of student in laboratory, experimental write-up, presentation, oral, and test (surprise/ declared/ quiz). The course teacher shall use at least two assessment tools as mentioned above for ISE.

**Course Contents:**

| Module 1: Introduction to Programming | 8 Hrs. |
|---|---|
| Introduction to Programming (Flow chart/pseudocode, compilation etc.), Constants, Variables (including data types).<br>**Assignments:**<br>Assignments to be carried out in any IDE (Integrated development environment) like Code Blocks, Sublime Text Editor, Turbo C editor and NetBeans for C/C++ Development.<br>1. Familiarization with programming environment IDE (Integrated development environment).<br>2. Draw flowchart, Write an algorithm for real world problem.<br>1. Programs to display different data type value and size.<br>2. Programs to demonstrate different operators and their order precedence. | |
| **Module 2: Arithmetic expressions and precedence** | **7 Hrs.** |
| Arithmetic, relational and logical operators, increment and decrement operators, conditional operator, bit-wise operators, assignment operators, expressions, type conversions, conditional expressions, precedence and order of evaluation.<br>**Assignments:**<br>1. Programs to solve simple computational problems using arithmetic expressions e.g. simple and compound interest. | |
| **Module 3: Conditional Branching and Loops** | **8 Hrs.** |
| Statements and blocks, if and switch statements, Loops- while, do-while and for statements, break, continue, goto and labels.<br>**Assignments:**<br>1. Programs to demonstrate problems on conditional branching e.g. roots of quadratic equation, finding a maximum/minimum value.<br>2. Programs to show statement block, conditional statement.<br>3. Programs to show different types of iteration / loop.<br>4. Implementation of iterative problems e.g., sum of series. | |
| **Module 4: Arrays, Functions and Recursion** | **10 Hrs.** |
| Arrays- concepts, declaration, definition, accessing elements, storing elements, arrays and functions, two-dimensional arrays, applications of arrays.<br>Designing structured programs, Functions basics, parameter passing, storage classes like extern, auto, register, static, scope rules, block structure, user defined functions, Recursion with examples<br>**Assignments:**<br>1. Programs to demonstrate matrix problems, string operations, sorting problems.<br>2. Programs to implement numerical methods problems (Root finding, numerical differentiation, and numerical integration): using array, function and recursion. | |
| **Module 5: Pointers and Structures** | **12 Hrs.** |
| Pointers- concepts, initialization of pointer variables, pointers and function arguments, address arithmetic, Character pointers and functions, pointers to pointers.<br>Derived types- structures- declaration, definition and initialization of structures, accessing structures, nested structures, arrays of structures, structures and functions, pointers to structures, self-referential structures, unions.<br>**Assignments:** | |

| | |
|---|---|
| 1. Programs to illustrate use of pointer with simple data type (create pointer variable, assign value, access value and show address using (* and &).<br>2. Programs to solve the problems using pointers and structures e.g. swap two numbers. | |
| **Module 6: File handling** | **7 Hrs.** |
| Input and output - concept of a file, text files and binary files, streams, standard I/O, Formatted I/O, file I/O operations, error handling.<br>**Assignments:**<br>1. File handling: Study and implementation file operations.<br>2. Programs to demonstrate simple read and write operation on the external text file.<br>3. Case study to demonstrate basic programming construct. | |

**Module wise Measurable Students Learning Outcomes :**
**After the completion of the course the student should be able to:**
**Module 1**

- grasp basics of representing problems into flow chart/pseudocode/algorithm.
- implement and test the algorithms, programs.

**Module 2:**

- grasp and formulate simple algorithms by using arithmetic expression and logical operators.
- implement and execute the programs and correct syntax and logical errors.

**Module 3:**

- implement conditional branching, iteration and recursion.

**Module 4:**

- apply functions to decompose problems.
- implement iterative problem by using recursive function.

**Module 5:**

- apply arrays, pointers and structures to formulate algorithms and programs.
- apply programming to solve matrix addition, multiplication problems and

searching/ sorting problems.
**Module 6:**

- grasp fundamentals of file handling.
- apply read and write operations onto external resource file.

| Course Name: Electronics Engineering Lab 4EN151 | L | T | P | Cr |
|---|---|---|---|---|
| | 0 | 0 | 2 | 1 |

**Pre-Requisite Courses:**

**Textbooks:**
1. R. P. Jain, "Modern Digital Electronics", Tata McGraw Hill, 4th edition, 2009
2. A. Anand Kumar, "Fundamentals of Digital Design", PHI, 4th edition, 2016
3. Robert Boylestad, Louis Nashelsky, "Electronic Devices and Circuits, Pearson, 11th edition, 2015
4. Ramakant Gaikwad, "Op-amp and Linear Integrated Circuits", Pearson,4th edition, 2015

**References:**
1. Morris Mano, "Digital Design", Pearson, 4th edition, 2011
2. Donald A. Neamen, "Electronic Circuit Analysis and Design", Tata McGraw Hill, 3rd edition, 2011
3. Robert F. Coughlin and Frederick F. Driscoll, "Operational amplifiers and linear integrated circuits", PHI, 6th edition, 2009

**Course Objectives:**
The aim of this course is to provide knowledge of basic electronics to first year engineering students, so that they can understand, design and implement small digital / analog electronic circuits.

**Course Learning Outcomes:**

| COs | After the completion of the course the student should be able to | Bloom's Cognitive | |
|---|---|---|---|
| | | Level | Descriptor |
| **CO1** | **identify** electronics components and instruments. | *II* | Application |
| **CO2** | **construct** digital IC, diode and op-amp based circuits. | *III* | Analyzing |

**CO-PO Mapping :**
**Computer Science and Engineering :**

| | a | b | c | d | e | f | g | h | i | j | k |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | | | | | **1** | | | | | | |
| **CO2** | | | | | **1** | | | | | | |

**Assessments :**
Teacher Assessment:
100% ISE, Continuous assessment based on lab performance, quiz related with experiments, circuit simulation task given in groups and oral at the end of semester

| Assessment | Marks | Evaluation |
|---|---|---|
| ISE | 20 | Continuous Assignment Evaluation |
| | 50 | Continuous Performance Evaluation based on declared tests /quizzes /mini project /seminar etc. |
| | 30 | Final performance lab test conducted at the end of semester (Implementation and Oral) |

**Course Contents:**

| |
|---|
| **Experiment List: (Minimum 13 Lab sessions)**<br>1) Identification of components and instruments required in lab to perform experiments based on Electronics.<br>2) Verification of truth table of all logic gates.<br>3) Realization of logic gates using basic building block (NAND/NOR).<br>4) Implementation of combinational logic circuit.<br>5) Study of P-N Junction diode characteristics<br>6) Working of Half-wave rectifiers<br>7) Working of Full-wave rectifiers<br>8) Working of clipper<br>9) Working of clampers<br>10) Study of transistor as a switch and amplifier (BJT and JFET)<br>11) Study of inverting and non-inverting amplifier (IC 741)<br>12) Implementation of opamp based application (Adder / Subtractor)<br>13) Working of multivibrator using IC 555 (Astable and Monostable) |
| **Measurable Students Learning Outcomes based on above experiments:**<br>After the completion of the course the student should be able to<br>1) identify and handle electronic components, ICs and instruments<br>2) implement and test diode, transistor and opamp based circuits<br>3) identify use of diode, transistor and opamp in various applications<br>4) apply knowledge to deal with electronic circuitry |
| **Computer Usage / Lab Tool:** Proteus Simulator, Analog / Digital Trainer kit, Digital Oscilloscope, Signal Generator, Multimeter and DC power supply. |

# Academic Rules and Regulations (V1.6)
# [UG]
# (After 5th Academic Council Meeting)

# Preface

Walchand College of Engineering, (WCE), Sangli is one of the oldest and renowned Engineering colleges in India. The college was established with an objective to provide quality technical education, research and training. WCE is recognized by its contribution to technical education, and involvement of its alumni in designing, planning and execution of engineering projects of national importance. It has established a firm foundation for technical education and research with a high-quality faculty and ethically sound disciplined alumni. The teaching-learning process is student centric and governed by the concept of outcome based education.

This booklet gives comprehensive information on the existing rules and regulations for B. Tech. programmes of all branches. All undergraduate programmes will be governed by these rules and regulations. The various departments are given a direction to excel in academics through these rules and regulations approved by the academic council from time to time, keeping in view the ever growing challenges and new developments. The stakeholders particularly the students, and parents/guardians, are advised to be fully familiar with the academic system of the college. Students should know the rules and regulations governing academic requirements, evaluation system, and grading system. These rules and regulations related to academics evolved over the period of time, after the college was awarded autonomy in 2007 by UGC. These rules are also changed from time to time as per the directives of UGC, AICTE and also by studying the rules of other reputed autonomous institutes. It is expected that this booklet will bring the transparency in the functioning of the college related with academics amongst students, faculty members, administrator, parents and other stakeholders. WCE, Sangli has student oriented academic system, every possible opportunity is provided to progress academically, and overall development of the students is ensured.

Date: 11$^{th}$ July 2016 Dean Academics Director
Release of V 1.6

# INDEX

## 1. DEFINITIONS

1. “College” means Walchand College of Engg., Sangli (WCE).
2. “BoG" means Board of Governors (Administrative Council).
3. “University” means Shivaji University, Kolhapur.
4. “Academic Council (AC)" means apex academic body governing the academic programmes and policies in WCE.
5. “Grievance Redressal and Discipline Committee (GRDC)" means committee appointed by Director to deal with cases of indiscipline.
6. “Complaint Redressal Committee (CRC)” means committee appointed by Director to deal with cases of unfair means/malpractice/s in examination.
7. “Board of Studies (BoS)" means departmental academic body common for UG and PG programmes.
8. “Semester" means period in which academic activities are carried out.
9. “Summer Term" means a period during summer vacation for approximately 3-4 weeks duration, during which remedial classes, industrial training, and soft skill training are conducted.
10. “Course" means theory/laboratory/seminar/project/mini project.
11. “Course credit" means weightage assigned to a course.
12. “Grade" means double letter assigned to indicate the performance of student in a course.
13. “Course teacher" means faculty member assigned to teach a course.
14. “Semester Performance Index (SPI)" means the weighted average of grade point of a student in a semester.
15. “Cumulative Performance Index (CPI)" means the weighted average of grade points for all the semesters completed by a student.
16. “Allowed to Keep Term (ATKT)" means allowed for admission after satisfying minimum credits criterion.
17. “Board of Examination (BoE)" means apex examination body implementing rules and regulations framed by AC.
18. “Grade Moderation Committee “(GMC)" means committee appointed by Controller of Examinations to moderate and finalize the grades assigned by course teachers.
19. “Academic Standing Committee (ASC)” means apex body next to AC to take decisions under emergent situations subjected to ratification by AC.
20. “Academic RRs” means rules and regulations governing academic system of the college.
21. “Departmental Advisory Board”(DAB) means departmental advisory body common for UG and PG programmes.
22. “Departmental Academic and Programme Evaluation Committee (DAPEC)” means departmental academic and advisory body next to BoS and DAB.

## 2. INTRODUCTION

2.1. All six undergraduate Engineering programmes (Civil, Mechanical, Electrical, Electronics, Computer science and Engg., and Information Technology) shall be governed by the rules and regulations provided in this version of academic RRs. The curriculum of each programme provides i) broad based knowledge; ii) quality content of courses; iii) academic flexibility; iv) scope for multi-disciplinary learning activities; v) opportunity for industry oriented projects. The curriculum designed shall be in line with the out-come based education. Apart from programme requirements, students shall compulsorily undergo foundation courses on sciences, humanities, and engineering; courses on management and economics. The stringent evaluation norms shall be followed to maintain quality of engineering education. The examination system shall be transparent and governed by rules, regulations and time-bound activities.

2.2. The medium of instruction throughout the programme shall be in English.

2.3. The semester system shall be adopted for academic activities in the college. Normally, all odd semesters shall start in third week of July except for first semester of B.Tech. and shall end in first week of November. All even semesters shall start in January and shall end in last week of April. The start of first semester for B. Tech. and M. Tech. shall be governed by admission schedule declared by Government of Maharashtra. Academic calendar shall be prepared and displayed before the start of every academic year.

2.4. The rules and regulations mentioned in this document shall be common to all undergraduate programmes (B.Tech.) offered by the college.

2.5. The provisions made in this document shall govern the policies and procedures, curriculum, course delivery, evaluation system and conduct of the examinations.

2.6. The rules and regulations here under shall be subjected to amendment made by the Academic Council (AC) from time to time, based on the recommendations of the BoS. All such amendments shall be applicable to all further batches including those already undergoing the programme.

2.7. The rules and regulations formulated in this document shall be subjected to revisions/refinement/updates/modifications through approval by the AC, from time to time, and shall be binding on all concerned stake holders, including the students, faculty, staff, departments, and institute authorities.

# 3. ORGANIZATION STRUCTURE AND ACADEMIC DEPARTMENTS

3.1. The academic administration of the college consists of committees and functionaries. The committees shall be AC, ASC, BoE, BoS, DAB and DAPEC, and functionaries shall be Director, Deputy Director, Dean Academics, Controller of examinations, Heads of Department, Programme academic coordinator, Programme evaluation coordinator, and First year programme coordinator.

3.2. The academic programmes of the college shall be governed by Rules and Regulations approved by the AC from time to time. The AC is a statutory and supreme body that governs all academic matters of the college, and the decisions of Chairman (AC) (Director of the college) shall be final in regard to all academic issues. All academic activities shall be scheduled through an approved academic calendar notified in the beginning of each academic year. ASC shall continuously assess the academic activities and makes appropriate revisions/modifications/improvements as and when required under emergent situations.

3.3. Academic departments and programmes offered

The college offers undergraduate programmes in engineering. The academic departments and the respective programme offered are given in Table 3.1.

**Table 3.1:** Academic Departments and Offered Programmes

| S. No. | Academic Department | Programme Offered | Programme Code | Department/Branch Code |
|---|---|---|---|---|
| 1 | Civil Engineering | Bachelor of Technology in Civil Engineering [B.Tech. (Civil)] | BTE | CV |
| 2 | Mechanical Engineering | Bachelor of Technology in Mechanical Engineering [B.Tech. (Mechanical)] | BTE | ME |
| 3 | Electrical Engineering | Bachelor of Technology in Electrical Engineering [B.Tech. (Electrical)] | BTE | EL |
| 4 | Electronics Engineering | Bachelor of Technology in Electronics Engineering [B.Tech. (Electronics)] | BTE | EN |
| 5 | Computer Science and Engineering | Bachelor of Technology in Computer Science and Engineering (B.Tech. (Computer Science and Engineering) | BTE | CS |
| 6 | Information Technology | Bachelor of Technology in Information | BTE | IT |

| | | | | |
|---|---|---|---|---|
| | | Technology<br>[B.Tech. (Information Technology)] | | |
| 7 | Humanities | - | - | HS |
| 8 | Mathematics | - | - | MA |
| 9 | Chemistry | - | - | CH |
| 10 | Physics | - | - | PH |
| 11 | Applied Mechanics | - | - | AM |

The normal duration of these academic programmes is eight semesters. An extension to this period may be given subjected to approval by AC.

## 4. ADMISSION

4.1. Regular and Lateral Entry

Regular entry refers to admission of students for first, second (excluding lateral entry), third, and final year of the programme in odd semesters.

Lateral entry refers to admission of students for second year directly through Diploma qualification.

4.2. The admission process and eligibility to various undergraduate programmes for regular entry (first year) and lateral entry (second year) are governed by the norms and procedures of Government of Maharashtra.

The candidate shall be provisionally admitted subject to fulfilment of eligibility criteria prescribed by government/University from time to time.

4.3. Each student shall be allotted Programme Registration Number (PRN) at the time of first admission/registration and that will be a permanent identification number. The number shall be

| YYYY | PPP | BB | SS | NNN |
|---|---|---|---|---|
| Year | Programme | Department/Branch | Specialization/ Streams | Roll Number |

SS is applicable to M. Tech. programme only, for B. Tech. programmes SS shall be 00.

This number shall never change and the allotted number shall not be offered to any other student even after cancellation of admission. The number shall be valid till the student completes the programme or cancels the admission or is removed from the roll.

4.4. The students seeking admission (regular entry) to second, third and final year should have earned all the credits of the pre-previous year and at least 75% credits of the previous year. For example, for admission to 5$^{th}$ semester (i.e. 3$^{rd}$ year of programme), a student should have earned all credits of the first year and 75% credits of the second year. Similarly for admission to the 7$^{th}$ semester (i.e. 4$^{th}$ year of programme), a student should have earned all the credits of the second year and 75% credits of the third year. However, if calculation of 75% credits results in to a mixed number (integer + proper fraction) then the integer part of that number shall be considered for taking decision related with this clause.

4.5. Entry from University Pattern to Autonomous Pattern

Students admitted to WCE in pre-autonomous status and desirous of seeking re-admission shall be eligible for admission in autonomous status only in odd (3$^{rd}$, 5$^{th}$, and 7$^{th}$) semesters. Such students should have passed all the courses of previous semesters or fulfil the prevailing ATKT norms of Shivaji University, Kolhapur. The students admitted through ATKT norms shall clear backlog courses by appearing for the respective examinations of Shivaji University, Kolhapur. Further they shall undergo additional academic requirements (bridge courses) if any as specified by the BoS of the respective department to be at par with WCE autonomous curriculum. Students who have obtained condone in any of the subjects/courses of university curriculum by Shivaji University, Kolhapur shall be considered to have cleared that subject/course.

4.6. Change of programme/branch

Students shall be eligible to apply for change of branch after completing the first two semesters. The following rules/guidelines shall be used for considering their application for change:

i. The process of change of branch shall be carried out purely on merit basis subject to the rules of admissions prevailing at the time of such change.

ii. Students with fail grade (FF) in any course and/or having backlogs shall not be eligible to apply.

iii. The request for change of branch by a student from branch A to branch B shall be considered if number of students of branch B does not exceed the sanctioned capacity of branch B.

iv. All such transfers shall be effected only once at the beginning of third semester. No application for change of branch during subsequent semesters shall be entertained.

v. Students allotted with a branch of their choice should accept it and no further request for change shall be entertained.

vi. There shall be no change in PRN number for students availing facility of branch change.

4.7. Temporary Withdrawal

A student shall be permitted to withdraw temporarily from the college for the reasons beyond his/her control. The applicable rules are:

i. The withdrawal shall be considered for a complete semester or in multiples of semester.

ii. The student shall apply to Dean Academics for such a withdrawal stating the reasons for such a withdrawal, along with supporting documents, consent of his/her parent/guardian and clearance/no due certificate from all the concerned departments.

iii. Dean Academics shall peruse the case and recommend for the approval from AC/ASC.

iv. A student availing of temporary withdrawal from the College under the above provision shall be required to pay such fees and/or charges as may be fixed by the college until such time as his/her name appears on the student's roll list. However, it may be noted that the fees/charges once paid shall not be refunded.

v. Normally, a student will be entitled to avail the temporary withdrawal facility only once during the programme. However, request for any further withdrawal for the concerned student shall have to be approved by the AC of the college.

4.8. Termination from the Programme

A student shall be terminated from the programme in the following cases:

i. Involved in ragging and not obeying discipline stipulated by college;

ii. Successive failures in first Year: Normally a student who fails to obtain eligibility for admission to third semester within three successive academic years shall be declared as Not Fit for Technical Education [NFTE]. Such students shall be permitted for only one year to continue the education in the college provided the permission is accorded by AC. Director shall be authorized to terminate such student.

iii. Not completing programme in prescribed period: Students shall have to complete B. Tech. programme in maximum period of 6 years (12 semesters) for regular entry and 5 years (10 semesters) for lateral entry from the date of first admission. However, genuine cases with proper justification may be referred to AC for extending programme completion period. Such student will be declared as Failed to Complete Technical Education [FCTE].

## 5. ACADEMIC CALENDAR

5.1. The academic activities of the college shall be governed by academic calendar prepared by Dean Academics and approved by the AC/ASC. It shall be notified at the beginning of each academic year. Academic calendar shall incorporate schedule of admission, course registration, course delivery, examination/evaluation, course feedback, course/graduate exit survey, co-curricular activities, extra-curricular activities, holidays, compensation for academic loss, meetings (AC, ASC, IQAC, BoE, Alumni), academic audit, and vacation.

5.2. The curriculum shall be typically delivered in two semesters in an academic year. Each semester shall be of 20 weeks (100 days) duration, including evaluation, grade moderation and result declaration. Generally, 13-14 weeks (72-77 days) for course content delivery and 4-6 weeks (20–30 days) for examination/evaluation shall be assigned in each semester. The academic session in each semester shall provide at least 75 teaching days, with 40 hours of teaching per week. The first and second semesters of an academic year normally shall begin from mid-July and first week of January respectively.

5.3. The academic calendar should be strictly adhered to, and all other activities including co-curricular and extra-curricular activities should be scheduled so as not to interfere with the curricular activities as stipulated in the academic calendar.

5.4. The non-conduct of academics on any particular teaching day for what so ever reason shall be made up by having the class/lab/teaching sessions conducted on a suitable Saturday by following the particular class time table of that teaching day which was so lost.

## 6. ATTENDANCE

6.1 All students should attend the classes and expected to be regular (100% attendance) for all the courses. The attendance records of students should be maintained in WCE moodle by the course teacher. The students should check their attendance in WCE moodle regularly and should contact respective course teacher for any discrepancy/grievance.

6.2 A maximum of 25% exemption in the attendance may be permitted for the approved leave of absence from class teacher/HoD for participating in co-curricular/extra-curricular activities/medical emergencies/reasons beyond the control of student. Students with more than 75% attendance shall not be imposed with any grade penalty.

6.3 The students with less than 75% attendance in theory course/s shall be liable for grade penalty as below:

i. Students having attendance greater than or equal to 65% but less than 75% shall be allowed to appear for ESE in that course with maximum grade of BC.

ii. Students having attendance greater than or equal to 50% but less than 65% shall be allowed to appear for ESE in that course with maximum grade of CC.

iii. Students having attendance less than 50% shall be awarded with XX1 grade in that course.

6.4 Students reported having "non-satisfactory performance" in a laboratory/seminar/mini project/project by the course teacher shall obtain XX1 grade. Non-satisfactory performance shall be reported in case of poor attendance or not satisfying/fulfilling the requirements for these courses.

6.5 Students obtaining XX1 grade in a course/s shall not be eligible to appear for ESE in that semester and also makeup examination in that academic year for these course/s. The performance of such students in ISE and MSE for this course/s shall be cancelled.

6.6 Students obtaining XX1 grade shall re-register for the course/s in subsequent year.

6.7 Students obtaining "XX1" grade in more than three courses in a regular semester shall be detained for that semester and shall not be allowed to appear for ESE in that semester and also make up examination in that academic year for any of the courses. The performance of the student in ISE and MSE for all courses shall be cancelled. Such students shall have to re-register for all courses of that semester in next academic year and undergo all evaluations along with regular students.

## 7. CURRICULUM

7.1. There shall be a prescribed course structure for each of the academic programmes and in general terms it shall be known as the curriculum of courses of study. The curriculum prescribes all the courses of study semester-wise with credits, assigned teaching/contact hours, evaluation scheme and minimum requirements for the award of degree. The curriculum revisions/reforms/revamping shall be a continuous process governed by outcome based education, choice based credit system and AICTE guidelines.

7.2. The components of curriculum with the weightages assigned are given in Table 7.1. The weightage given for these components are in line with those suggested by AICTE.

**Table 7.1:** Components of Curriculum

| S. No. | Component of curriculum | Weightage assigned (% in terms credit) |
|---|---|---|
| 1 | Humanities, Social science and Management | 6 |
| 2 | Basic sciences including mathematics | 15 |
| 3 | Engineering science | 15 |
| 4 | Professional core | 34 |
| 5 | Professional elective | 15 |
| 6 | Open elective | 5 |
| 7 | Project work, Seminar, Internship in industry etc. | 10 |

7.3. The curriculum shall have credit and audit courses. The structure of curriculum for a programme and course syllabi shall be approved by AC on recommendation of respective BoS.

7.4. Normally number of courses in a semester shall not be more than six for theory and four for laboratory courses.

7.5. Open electives offered by any parent department shall be the courses listed in the curriculum structure under the open elective category. These shall be offered to students of any other department (excluding parent department) in 5$^{th}$ and 6$^{th}$ semester and any other department (including the parent department) in 7$^{th}$ semester. Normally, professional and open electives shall be conducted if minimum of fifteen students opt for that elective course.

7.6. Major project work shall be in 8$^{th}$ semester. Project work in the final year facilitates students in exhibiting their technical knowledge and professional skills to address a solution to societal/industrial problems. It also encourages students to work in teams and adopt project management skills. The preparatory work for the project shall be carried out in 7$^{th}$ semester under pre-project work. The students shall have an option to carry out the project either within campus or in industry/autonomous institutes/reputed organizations. Normally, major project work shall be carried out by not more than five students in a group. The formation of project groups shall be based on policy of respective departments. The students shall be encouraged to opt for Sponsored Project At Industry/Institute (SPAI). The projects under SPAI/any project outside the campus require approval from concerned department.

7.7. Process and guidelines for SPAI shall be:

i. Students may opt for SPAI to be carried out in 8$^{th}$ semester.

ii. Students opting for SPAI should decide, identify and interact with relevant industry/institute in 7$^{th}$ semester itself. However, as per the specific needs of a particular department, the departmental academic and programme evaluation committee shall decide appropriately. Students shall take necessary help from their parent department/Training and Placement Officer (TPO) to establish contact with industries/institutes.

iii. Students shall submit the application attached with relevant details viz. correspondence with industry, area and nature of project to the department before the end of 7$^{th}$ semester.

iv. Director/Dean Academics shall issue permission letter to the students on the recommendation of HoD. Students shall be allowed to work in the industry/institute for maximum of 13 weeks during the project work in 8$^{th}$ semester.

v. An internal guide from the parent department and mentor from industry/organization/institute where project is to be undertaken shall be allocated to student. Both guides should discuss and finalize the scope of project work and monitor the progress together.

vi. Internal guide should visit the industry at least twice in a semester to see the progress of his/her student. Faculty will be supported with travelling and dearness allowance to visit industry/institute.

vii. Students should maintain a diary, regularly write progress and get the approval from both internal and external guides at least twice in a month either by physically reporting or through email communication.

viii. Progress report and certification of the project work undertaken shall be submitted by the student to the respective guide. The mode of evaluation shall be same as adopted for students carrying out projects in-house.

7.8. A course code shall be NBBLMJ [e.g. 3CV313; 2OE301; 3IC401]

where, N: revision number, BB: Code of branch for core courses and departmental professional electives/Code OE for open elective/Code IC for institute mandatory course, L: Year/Level of course, and MJ: Course number [01 to 10 (semester I) and 21 to 30 (semester II) for theory core courses; 11 to 20 (semester I) and 31 to 40 (semester II) for theory professional electives; 41 to 50 (semester I and II) for seminar and mini-projects; 51 to 70 (semester I) and 71 to 90 (semester II) for laboratory courses; 91 to 99 (semester I and II) for project; 01-07 (semester I), 08-14 (semester II) for open electives offered by AM; 15-21 (semester I), 22-28 (semester II) for open electives offered by CV; 29-35 (semester I), 36-42 (semester II) for open electives offered by ME; 43-49 (semester I), 50-56 (semester II) for open electives offered by EL; 57-63 (semester I), 64-70 (semester II) for open electives offered by EN; 71-77 (semester I), 78-84 (semester II) for open electives offered by CS; 85-91 (semester I), 92-98 (semester II) for open electives offered by IT]

7.9. A typical description of course syllabus shall consist of course title, course code, teaching hours per week for lecture/tutorial/practical, credit, pre-requisites, text books, reference books, objectives, outcomes with relevant Bloom's taxonomy levels, mapping of course outcome with programme outcome, assessment scheme, content, and module-wise outcomes (for theory course).

7.10. The details of curriculum structure and course details shall be published in college intranet (ftp//:10.10.16.16) and website (www.walchandsangli.ac.in).

7.11. Summer term shall also be conducted for academically weak students during the academic year for theory courses. Remedial classes and student-teacher interactive sessions shall be conducted during summer term. The duration of summer term shall be typically 3-4 weeks. The registration for the courses in summer term shall be mainly to students who have obtained FF grade in a course in the current academic year. Students with XX1 grade shall also be allowed for registration to summer term. However, students with XX1 grade shall not be allowed to appear for makeup examination in that semester as mentioned in section 6.5. Attendance penalty given in section 6.3 shall be applicable for makeup examination also.

Students with FF/XX1 grade may register for course/s in a summer term by paying prescribed fee for each course. A particular course/s shall be conducted if the number of registered students for a course/s is more than 10. The registered students should attend the classes regularly. Attendance rules shall be applicable to summer term also.

7.12. Credit System:

The primary purpose of the credit system is continuous evaluation of a student's performance which is measured by the number of credits the student has earned. Typically, credit measures the quantum of work involved in a course. The cumulative performance index (CPI) is calculated based on the course credits and grades obtained by the student. A minimum number of earned credits and a minimum CPI should be acquired in order to qualify for the degree.

7.13. A typical credit structure for various courses with various combinations of theory/ tutorial and laboratory/project/ seminar/ mini-project hours is given in Table 7.2.

**Table 7.2:** Assigned credits for various types of courses

| **Hours per week per student for** | | | **Credits assigned** |
|---|---|---|---|
| **Theory** | **Tutorial/ Seminar** | **Laboratory/ Project** | |
| 0 | 0 | 2 | 1 |
| 0 | 1 | 0 | 1 |
| 1 | 0 | 0 | 1 |
| 0 | 0 | 4 | 2 |
| 1 | 1 | 0 | 2 |
| 1 | 0 | 2 | 2 |
| 3 | 0 | 0 | 3 |
| 2 | 0 | 2 | 3 |
| 2 | 1 | 0 | 3 |
| 3 | 1 | 0 | 4 |
| 3 | 0 | 2 | 4 |
| 4 | 0 | 0 | 4 |
| 2 | 0 | 4 | 4 |
| **Credit = Theory hours + Tutorial hours + 0.5 (Laboratory hours)** | | | |

A student can earn credits for a particular course by fulfilling the minimum academic requirements of attendance and evaluation. No credits shall be awarded if a student satisfies the minimum attendance requirements but fails to meet minimum evaluation requirements.

7.14 The total number of credits required for completing a programme typically is in the range of 175-180 for regular entry and 148-155 for lateral entry. The exact number of credits required is mentioned in the curriculum structure for the respective programme. The total number of credits in a semester in which a student shall register is generally 23-25. Normally, the maximum number of credits per semester shall not exceed 30.

## 8. REGISTRATION

8.1. The students admitted through regular and lateral entry shall be automatically registered for the courses of that year. Such students shall not have to register separately for the courses.

8.2. A regular admitted student and willing to apply for CPI improvement/having FF/XX1/XX2 grade in a course/s shall re-register for the courses in which the student is seeking grade improvement/passing grade. Such students have to complete the course re-registration procedure alongwith regular students.

8.3. A student, not admitted as regular student, shall have to re-register for the courses in which he/she has obtained FF/XX1/XX2 grade. Such students have to complete the course re-registration procedure as per the schedule in academic calendar. A student obtaining “XX1” grade in less than four courses in a regular semester shall be allowed to re-register for such course/s in next academic year.

8.4. Course re-registration procedure shall include filling up course registration form prescribed by Dean Academics office, verification by examination cell, recommendation by programme academic coordinator and HoD of respective department, payment of prescribed fee and final approval by Dean academics. Student/s re-registered for course/s shall interact with concerned course teacher for any academic help. Student/s shall complete all the academic and evaluation requirements in consultation with course teacher.

8.5. Re-registration, according to rules, shall be carried out as per the schedule given in academic calendar. Late registration may be permitted only for valid reasons and on payment of late registration fees. In any case, registration should be completed before the prescribed last date for registration.

8.6. In-absentia registration may be allowed only in rare cases at the discretion of the Dean Academics and with prior permission.

8.7. Course re-registration shall be done for the course/s of both semesters at the start of academic year as per the schedule in academic calendar.

## 9. COURSE EVALUATION

9.1 The evaluation of theory courses shall be on the basis of two In-Semester Evaluations (ISE 1 and ISE 2), one Mid-Semester Exam (MSE), and one End Semester Examination (ESE). The weightage for each of these evaluations is given in Table 9.1.

**Table 9.1:** Weightage of Evaluation

| **Evaluation** | **Weightage** | |
|---|---|---|
| | **Credit course** | **Audit course** |
| ISE-I | 10% | 35% |
| ISE-II | 10% | 35% |
| MSE | 30% | 30% |
| ESE | 50% | Nil |

9.2 In-Semester Evaluation (ISE) for a theory course shall be carried out using assessment tools such as assignment, oral, seminar, test (surprise/declared/quiz), and group discussion. The course teacher shall use at least one assessment tool per ISE. The assessment tool used for ISE 1 shall not be used for ISE 2. The assessment tool/s for ISE shall be decided and announced by the course teacher at the beginning of the course. The record of evaluation shall be maintained by course teacher and shall submit it during academic audit.

9.3 The ISE 2 component for theory course shall not be shown to students and all other components shall be shown to students.

9.4 MSE for every theory course (credit and audit) shall be conducted centrally as per the schedule indicated in the academic calendar. MSE shall be of 30 marks and 1.5 hour duration. MSE shall usually be based on modules 1, 2 and 3. There shall be no re-examination for MSE.

9.5 ESE (written/online) for every theory credit course shall be conducted centrally. It shall be of 50 marks and of duration 2 hours, or as mentioned in the examination scheme approved by BoS of the respective programme. The examination shall be based on entire syllabus of the respective course. The weightage shall be 20-30% for the syllabus covered for MSE and 70-80% for the remaining syllabus after MSE. The question paper of ESE may have options up to 20% for all theory credit courses. A student absent for ESE of a course shall obtain “FF” grade. Such a student shall be allowed to appear for make-up examination. There shall be no re-examination for ESE.

9.6 Evaluated answer books of MSE and ESE theory courses shall be shown to students. It shall not be mandatory to show evaluated answer books to the students not present at the given time slot by the course teacher.

9.7 If any examinee is not in a position to write on account of temporary physical disability or injury due to accident and applies for a request for a writer with medical certificate from the Civil Surgeon to that effect, then a writer shall be allowed/ assigned by CoE to such examinee. Normally, such a writer shall neither be a student or a degree holder of any technical programme having similar competency. The examinee shall, however, apply in a prescribed proforma to CoE asking for permission to allow for such a writer. CoE shall then verify the medical certificate and give a permission letter to the examinee for using the writer. CoE shall then take the undertaking from the writer in a prescribed proforma. Such examinee shall produce the permission letter from CoE for using writer to the invigilator. Writer shall be allowed extra time as per section 9.8.

9.8 In case of student admitted with differently abled category/similar case/writer, who can write but at much slower speed as compared to a normal student, he/she may be allowed an extra time of 15 minutes for 30/50 marks paper and 30 minutes for 100 marks paper to write the examination for all the courses, provided he/she seeks permission from CoE for extra writing time on account of his/her disability by producing medical certificate from Civil Surgeon to this effect.

9.9 The paper setting, assessment and conduct of ISE 1, ISE 2 and MSE for audit course shall be as per rules of credit course. Answers books of MSE for audit course shall be shown to students.

9.9 The evaluation for laboratory courses shall be on the basis of either ISE or ISE and ESE each having 50% weightage. ISE shall be continuous evaluation carried out throughout the semester and based on performance of student in laboratory, experimental write-up, presentation, oral, and test (surprise/declared/quiz). The course teacher shall use at least two assessment tools as mentioned above for ISE. ESE shall be based on either oral or performance and oral as per the examination scheme. ISE marks for laboratory course shall be shown to students and ESE marks shall not be shown to students. External and internal examiners shall conduct ESE.

9.10 The evaluation of courses, such as seminar, mini-projects where ISE is the only component, shall be continuous in the form of presentation, test (surprise/declared/quiz), assignment, oral and quality of report write-up. ISE marks shall be displayed.

9.11 The evaluation for project shall be on the basis of ISE and ESE each having 50% weightage. ISE shall be continuous evaluation carried out throughout the semester. A project evaluation committee composed of two faculty members related to subject area of project work and guide shall be constituted. The distribution of weightage for ISE shall be 25% each by two faculty members and 50% by guide. Each student shall give at least two progress seminars before the committee as per the schedule in academic calendar. A report on project work shall be submitted by students at the time of second progress seminar. ESE in the form of presentation followed by oral shall be conducted by an external examiner and internal examiner/guide. The above mode of evaluations and attendance for ISE and ESE as and when declared shall be mandatory for all students inclusive of students carrying out their project work in industry (outside the campus)/SPAI.

9.12 A common rubric shall be developed to assess seminar, mini-project and major project courses for each programme by departmental academic and programme evaluation committee. The rubric for the laboratory course shall be developed by the concerned course coordinator. A course coordinator is the teacher who conducts the relevant theory course or as decided by the departmental academic and programme evaluation committee.

## 10. THE GRADING SYSTEM

10.1 Students shall be assigned a grade based on performance in all components of evaluation/examination scheme of a course as per the structure. The grade indicates an assessment of the student's performance and shall be associated with equivalent number called a '*grade point*'. The performance of the student as per the grade point on a 0-10 scale shall further fall into a letter grading system as shown in Table 10.1.

**Table 10.1:** Grade points

| Letter Grade | Grade point | Description |
|---|---|---|
| AA | 10 | Outstanding |
| AB | 9 | Excellent |
| BB | 8 | Very good |
| BC | 7 | Good |
| CC | 6 | Average |
| CD | 5 | Below average |
| DD | 4 | Marginal |
| FF | 0 | Fail due to poor performance |
| XX1 | 0 | Fail due to attendance shortage |
| XX2 | 0 | Fail due to disciplinary action |
| PP (only for non-credit audit courses) | 0 | Passed |
| NP (only for non-credit courses) | 0 | Not passed |

An 'AA' grade stands for outstanding achievement relative to the class. The 'CC' grade stands for average performance and it refers to 'average' as per course teacher's expectations in a holistic sense and is not based on the class average. The 'DD' grade stands for marginal performance and is the minimum passing grade. The 'FF' grade denotes poor performance. A student who obtains FF grade in any course shall either appear for make-up examination or re-register for the course/s, till a passing grade is obtained.

The 'XX1'grade denotes failure of student due to shortage of minimum attendance (less than 50% of the total hours engaged for that course) and not satisfactory performance in laboratory course.

The 'XX2'grade denotes failure of student due to disciplinary action.

A student who obtains 'XX1/XX2' grade in any course has to necessarily re-register for the course in the subsequent semesters until a passing grade is obtained. Such students shall not be allowed to appear for makeup examination.

10.2 Relative grading shall be applicable to courses where the number of students registered is greater than or equal to 15.

10.3 The concerned faculty shall use ISE 1, ISE 2, MSE and ESE marks to decide the total marks. The marks of each mode of evaluation shall be up-to one decimal place and shall not be rounded. The total of ISE 1, ISE 2, MSE and ESE will be computed and rounded to the nearest higher integer.

10.4 A student will be given maximum of two grace marks per course to obtain passing grade in maximum of two courses provided he/she has passed in all other courses for that semester. If a student has failed in more than two courses, no grace marks will be applicable in any course.

10.5 The grace marks shall be applicable only to regular students and shall not be applicable to any re-registered student in a course.

10.6 FF grade shall be assigned to a student in a theory course in the following cases;

i. Sum of marks obtained by the student in ISE 1, ISE 2, MSE, ESE, and grace (if any) is less than 40.

ii. Marks obtained in ESE are less than 20.

10.7 FF grade shall be assigned in a laboratory course to a student who shall get less than 40% marks in ESE. XX1 grade shall be assigned in a laboratory course to a student obtaining less than 40% marks in ISE.

10.8 In the further grading process, the failed students shall be excluded.

10.9 Then, the mean (μ) and standard deviation (σ) of total marks of passed students shall be computed. From these, the relative grading thresholds shall be decided with the use of Tables 10.2 and 10.3 for theory and lab./ proj./ mini-proj /seminar respectively.

**Table 10.2:** Relative grading thresholds for theory credit courses

| Theory Credit Course | | |
|---|---|---|
| Grade | ≥Min Threshold | < Max Threshold |
| FF | 0 | 40 |
| DD | 40 | Max ( 43, Min [ ⌊(μ- 1.745*σ), 46] ) |
| CD | Max ( 43, Min [ ⌊(μ- 1.745* σ), 46] ) | Max ( 47, Min [ ⌊(μ- 1.175 *σ), 52 ] ) |
| CC | Max ( 47, Min [ ⌊(μ- 1.175 *σ), 52 ] ) | Max ( 56, Min [ ⌊(μ- 0.613 *σ), 63 ] ) |
| BC | Max ( 56, Min [ ⌊(μ- 0.613 *σ), 63 ] ) | Max ( 64, Min [ ⌊(μ- 0.05 *σ), 73 ] ) |
| BB | Max ( 64, Min [ ⌊(μ- 0.05 *σ), 73 ] ) | Max ( 70, Min [ ⌊(μ+ 0.5836* σ), 82] ) |
| AB | Max ( 70, Min [ ⌊(μ+ 0.5836* σ), 82] ) | Max ( 75, Min [ ⌊(μ+ 1.225* σ), 90] ) |
| AA | Max ( 75, Min [ ⌊(μ+ 1.225* σ), 90] ) | 100 |

**Table 10.3:** Thresholds for Lab./ Proj./ Mini-Proj /Seminar

| Lab Course | | |
|---|---|---|
| Grade | ≥Min Threshold | < Max Threshold |
| FF | 0 | 40 |
| DD | 40 | Max ( 43, Min [L (μ- 2.336* σ), 46] ) |
| CD | Max ( 43, Min [L (μ- 2.336* σ), 46] ) | Max ( 47, Min [L (μ- 1.88* σ ), 52 ] ) |
| CC | Max ( 47, Min [L (μ- 1.88* σ ), 52 ] ) | Max ( 56, Min [L (μ- 1.475* σ), 63 ] ) |
| BC | Max ( 56, Min [L (μ- 1.475* σ), 63 ] ) | Max ( 64, Min [L (μ- 0.84* σ), 73] ) |
| BB | Max ( 64, Min [L (μ- 0.84* σ), 73] ) | Max ( 70, Min [L (μ- 0.1* σ), 82 ] ) |
| AB | Max ( 70, Min [L (μ- 0.1* σ), 82 ] ) | Max ( 75, Min [ L (μ+ 0.807* σ), 90] ) |
| AA | Max ( 75, Min [ L (μ+ 0.807* σ), 90] ) | 100 |

10.10 After the relative grade thresholds are calculated, the faculty shall check the histogram of the grades and adjust the thresholds to get nearly bell shaped histogram.

10.11 After this the faculty shall get the grade thresholds, approved from GMC. After approval, the faculty shall lock the grade thresholds.

10.12 The faculty then shall review the boundary cases for each grade and may assign max +1 grace (ISE) mark to those boundary cases. This shall not change the grade boundaries.

10.13 The grades shall be calculated as per the Tables 10.2 and 10.3 and assigned to each student.

10.14 The faculty shall prepare the grade sheet, verify it, sign on it, get the signature of the GMC and handover the grade sheet to the HoD.

10.15 HoD shall receive grade sheets of all courses of the department from respective faculty, verify them, and approve it and display the class wise provisional result on the departmental notice board.

10.16 Absolute grading is applicable to courses where the number of students registered for a course is less than 15. Allocation of grace marks shall be same as mentioned in 10.4.

The thresholds for absolute grading are given in Tables 10.4 and 10.5.

**Table 10.4:** Absolute grading thresholds for credit course

| Grade | Min Threshold | Max Threshold |
|---|---|---|
| FF | ≥ 0 | < 40 |
| DD | ≥ 40 | < 45 |
| CD | ≥ 45 | < 50 |
| CC | ≥ 50 | < 60 |
| BC | ≥ 60 | < 70 |
| BB | ≥ 70 | < 80 |
| AB | ≥ 80 | < 90 |
| AA | ≥ 90 | ≤100 |

Table 10.5: Absolute grading Thresholds for audit courses

| Grade | Min Threshold | Max Threshold |
|---|---|---|
| NP | ≥ 0 | < 40 |
| PP | ≥ 40 | ≤100 |

CPI shall be calculated as per absolute grading system for the students switched over from university pattern to autonomous pattern.

10.17 Makeup Examination

i. There shall be a makeup examination for all courses (theory and laboratory) once in a year. The makeup examination for an academic year shall be conducted before the commencement of an odd semester of the next academic year.

ii. The students failed in an odd semester and/or even semester in theory/laboratory credit course in an academic year shall be allowed to appear for a makeup examination for the same academic year. A student failed in an audit course shall have to re-register for the course/equivalent course, whenever it is offered in subsequent semester/s.

iii. Also the students, who have secured DD or CD grade in a course in an odd semester or even semester in an academic year and applied for CPI improvement, can appear for such makeup examination for the same academic year. Students with XX1/XX2 grade in a course shall not be allowed to appear for makeup examination of that course in that year.

iv. If a student applies for appearing for such makeup examination for a theory course, the MSE, ISE 1 and ISE 2 marks of the course shall be null and void. Also grade obtained in the course during regular odd or even semester examination shall be null and void.

v. The makeup examination for a theory course shall be of 100 marks and shall be based on all modules in the syllabus with equal weightage to each module. The question paper shall not have any options (no internal options also).

vi. ISE component of student performance in regular semester for a laboratory course shall be retained and makeup examination shall be conducted for ESE component either with oral/performance and oral as per examination scheme of that course.

vii. For makeup examination absolute grading shall be used and Table 10.4 shall be applied for assigning the grades.

viii. The evaluated answer books of makeup examination shall be shown to students.

ix. Grace marks shall not be awarded in makeup examination.

x. If the student fails to clear the course, even in make-up examination, he/she shall have to re-register for the course whenever it is offered and undergo all the modes of evaluations afresh.

xi. There shall not be any other re-examination for makeup examination for what so ever reason.

10.18 Revaluation

A provision of addressing grievance by a student in evaluation of his/her answer book for a course/s in ESE and makeup examination is made in terms of revaluation. If student is not satisfied with the evaluation of his/her answer books in ESE and makeup examination, he/she may apply for revaluation by paying prescribed fee after the declaration of result. If the marks awarded in the paper before and after revaluation vary by 10% or more of the maximum marks assigned to that paper, then marks after revaluation shall be accepted for the revision of result. However, irrespective of what is stated above, the marks obtained after revaluation shall be accepted if the candidate gets the benefit of passing the examination. In any case revaluation fee shall not be refunded.

10.19 The grade "PP" (Passed)/ "NP" (Not Passed) shall be awarded for audit courses depending upon the performance of a student evaluated by the faculty in-charge. No grade points shall be associated with these grades and performance in these courses shall be not taken into account in the calculation of the performance indices (SPI, CPI). However, the award of the degree shall be subject to obtaining a "PP" grade in all such courses.

10.20 Transfer of credits

In order to provide opportunity to students for studying in different learning environment, normally third year students can be sent to other reputed autonomous institutes for one semester under credit transfer. Students can avail credit transfer from other autonomous colleges for one semester provided the curriculum of both the colleges have same minimum three core courses in that semester. The remaining courses in that semester of that institute can be taken as professional electives. Grades obtained by such credit students from that institute will be suitably transferred to the grade card of WCE after approval from CoE, Dean Academics and Director. Such credit transfer is mutually possible from both institutes.

10.21 CPI improvement

i. A student in third and final year, and student who has passed final year B. Tech. shall be permitted to apply for CPI improvement provided his/her CPI is less than 6.50 (for students admitted before 2014-15)/6.75 (for students admitted after 2014-15) by the end of second/third/final year. Such students may apply for CPI improvement by registering for the course/s, of current academic year or immediately preceding academic year, in which the student has obtained DD/CD grade.
[e.g. 1. A student in final year may apply for the course/s of final and third year. The student shall be permitted to appear for makeup examination in final year /re-register for the course/s of third year for CPI improvement.
2. A student in third year may apply for the course/s of third and second year. The student shall be permitted to appear for makeup examination in third year /re-register for the course/s of second year for CPI improvement.]

ii. Re-registration should be done as per schedule in academic calendar.

iii. A student who has passed final B. Tech. shall apply for CPI improvement within 15 days after declaration of makeup examination result. He/she shall re-register for the course/s of final and third year in which the student wants to apply for grade improvement. Such students shall return all the concerned original grade cards to CoE.

iv. If the grade obtained by the student at the improvement examination is improved, it shall be considered as the final grade. For such students new grade card shall be issued with a remark “grade after improvement” for that course/s in which grade is improved.

v. No student shall be permitted to improve grades in courses like laboratory/seminar/mini-project/project.

vi. A student shall be permitted to apply for CPI improvement by re-registering for maximum of five courses in an academic year.

## 11. CALCULATION OF PERFORMANCE INDICES

11.1 The overall performance of a student shall be indicated by indices: FYPI First Year Performance Index (FYPI), Semester Performance Index (SPI) and Cumulative Performance Index (CPI).

11.2 The performance of a student in a semester shall be indicated by a number called SPI.

11.3 SPI shall be the weighted average of the grade points obtained in all the courses registered by the student during a semester.

11.4 Calculation of SPI.

$$SPI = \frac{\sum_{i}^{n} C_i G_i}{\sum_{i}^{n} C_i}$$

where, $C_i$ = number of credits earned in $i^{th}$ course of semester,
$i = 1 \ldots n$ represent number of courses in which the student has registered in that semester,
$G_i$ = grade point earned in $i^{th}$ course.

11.5 SPI and CPI are calculated only after make-up examination.

11.6 First Year Performance Index (FYPI):

$$FYPI = \frac{\sum_{i}^{n_f} C_i G_i}{\sum_{i}^{n_f} C_i}$$

where, $C_i$ = number of credits earned in $i^{th}$ course of first year,
$i = 1 \ldots n_f$ represent number of courses in which the student has registered in first year,

$G_i$ = grade point earned in $i^{th}$ course.

11.7 FYPI shall reflect all the courses undergone by a student in the first year including the courses in which he/she has failed. FYPI may get modified in the subsequent semesters whenever a student clears his/her first year backlog courses.

11.8 FYPI shall be calculated after the make-up examination on the basis of the grade obtained by that student in a make-up examination. FYPI shall be calculated for the students admitted prior to 2014-15. FYPI shall not be calculated for the students admitted for academic year 2014-15 and onwards.

11.9 Cumulative Performance Index (CPI):

CPI is the weighted average of the grade points obtained in all the courses registered by a student from the beginning of the third semester (for the students admitted prior to 2014-15) and first semester (for the students admitted for academic year 2014-15 and onwards) of the programme.

$$CPI = \frac{\sum_{j}^{m} C_j G_j}{\sum_{j}^{m} C_j}$$

where, j = 1,…m represent the number of courses registered by the student upto the semester upto which CPI is to be calculated.

11.10 FYPI, SPI and CPI will be rounded up to second decimal.

11.11 Conversion of CPI into equivalent percentage

The final CPI is converted into equivalent percentage for students admitted prior to 2014-15 and from 2014-15 is given in Table 11.1.

Table 11.1: CPI conversion to Percentage

| **CPI of students admitted** | | **Equivalent Percentage** |
|---|---|---|
| **Prior to 2014-15** | **2014-15 onwards** | |
| 6.00 | 6.25 | 55 |
| 6.50 | 6.75 | 60 |
| 7.00 | 7.25 | 65 |
| 7.50 | 7.75 | 70 |
| 8.00 | 8.25 | 75 |
| 8.50 | 8.75 | 80 |
| 9.00 | 9.25 | 85 |
| 9.50 | 9.75 | 90 |

11.12 Students admitted prior to 2014-15 and passed with CPI above 6.50 will be awarded first class else pass class. Student admitted after 2014-15 and passed with CPI above 6.75 will be awarded first class else pass class.

## 12. GRADE REPORT

12.1 A grade report in the form of grade card shall be issued to students at the end of academic year after the declaration of makeup examination results.

12.2 The grade card shall include the following;

i. The list of courses registered for an academic year along with credits.
ii. The letter grade obtained in each course.
iii. The total number of credits earned by a student.
iv. SPI, FYPI (if applicable) and CPI.
v. Examination details.

12.3 Grading System, calculation of performance indices and conversion of CPI to equivalent percentage shall be provided on the back page of grade card.

12.4 Result and class obtained shall be indicated only in the grade card of final year.

## 13. AWARD OF DEGREE

13.1 A student shall be eligible for the award of B. Tech. Degree from the College and the University provided the student has:

i. Registered and passed all the prescribed courses and earned minimum credit requirement for the degree.

ii. Obtained CPI $\geq$ 5.0.

iii. Paid all the institute dues and satisfied all the requirements prescribed.

iv. No case of indiscipline pending against him/her.

v. Obtained eligibility certificate from University.

13.2 AC shall recommend the list of students to Shivaji University for award of B. Tech. degree.

## 14. AWARD OF MEDALS

14.1 Awards shall be given to the students for excellent performance in academics, sports/extra-curricular/co-curricular activities, and overall performance.

14.2 Gold, silver and bronze medals shall be awarded to students with excellent academic performance based on CPI in each programme.

14.3 Student shall be awarded with academically best performing student amongst all the progrommes based on CPI.

14.4 An overall best student award shall be given for a student considering all-round performance in academics, extra- and co-curricular activities.

14.5 The award of scholarships/free-ships and other benefits shall be in accordance with rules of Government of Maharashtra and Government of India.

## 15 COMMITTEES AND FUNCTIONARIES

**15.1** The tenure of all committees shall be two years. The frequency of meeting shall depend on nature of the committee. One-third members of the committee shall constitute the quorum. The tenure of functionaries (coordinators) mentioned in this document shall be three years.

**15.2 Academic council:**

The Academic Council will be solely responsible for all academic matters, such as, framing of academic policy, approval of courses, regulations and syllabi, etc. The Council will involve faculty at all levels and also experts from outside, including representatives of the university and the government. The decisions taken by the Academic Council will not be subject to any further ratification by the Academic Council or other statutory bodies of the university. The composition and functions of the academic council are given below:

Composition:

i. Director of the college (Chairman).
ii. All Heads of department in the college.
iii. Four teachers of the college representing different categories of teaching staff by rotation on the basis of seniority of service in the college.
iv. Not less than four experts from outside the college representing such areas as industry, education, engineering etc., to be nominated by the Board of Governors (BoG)/Administrative council.
v. Three nominees of the university.
vi. Dean academics (member secretary).

***Functions and Powers:***

a. Scrutinise and approve the proposals with or without modification of the Boards of Studies with regard to courses of study, academic regulations, curricula, syllabi and modifications thereof, instructional and evaluation arrangements, methods, procedures relevant thereto etc., provided that where the Academic Council differs on any proposal, it will have the right to return the matter for reconsideration to the Board of Studies concerned or reject it, after giving reasons to do so.

b. Make regulations regarding the admission of students to different programmes of study in the college subjected to Government rules and regulations.

c. Advice measures for improving the quality of teaching, study and research, innovative evaluation and teaching-learning methods.

d. Make regulations for sports, extra-curricular activities, and proper maintenance and functioning of the playgrounds and hostels.

e. Recommend to BoG proposals for institution of new programmes of study.

f. Recommend to BoG for institution of scholarships, studentships, fellowships, prizes and medals, and to frame regulations for the award of the same.

g. Advice the BoG on suggestions(s) pertaining to academic affairs made by it.

h. Perform such other functions and such other duties as may be necessary and as may be assigned by BoG pertaining to academics.

**15.3 Academic Standing Committee (ASC)**

Composition:
The composition is same as that of AC except external members.
ASC shall perform the functions under emergent situations subjected to ratification by the AC.

**15.4 Board of Studies**

The Board of Studies (BoS) is the basic constituent of the academic system of an autonomous college. Its functions will include framing the syllabi for various courses, reviewing and updating syllabi from time to time, introducing new courses of study, determining details of continuous assessment, recommending panels of examiners under the semester system, etc. The composition and functions of the Board of Studies are given below:
Composition:

i. Chairman: Head of the concerned department
ii. Internal members: The entire faculty of each specialisation.
iii. Academic council nominee: Two experts in the subject from outside the college nominated by the Academic Council.
iv. University nominee: One expert nominated by the vice-chancellor from a panel of six recommended by Director.
v. Industry representative: One representative from industry/corporate sector/allied area relating to placement.
vi. One postgraduate meritorious alumnus to be nominated by Director.
vii. Co-opt members: Chairman, Board of Studies, may with the approval of the Director shall co-opt: Experts from outside the college whenever special courses of studies are to be formulated
viii. Member secretary: Programme Academic Coordinator

In addition to BoS for departments of various disciplines, there shall be a BoS for Basic sciences, Mathematics and humanities.
Composition of general BoS:

i. Chairman: First year programme coordinator
ii. Internal members: The entire faculty of each specialisation.
iii. Academic council nominee: Two experts in the subject from outside the college nominated by the Academic Council.
iv. University nominee: One expert nominated by the vice-chancellor from a panel of six recommended by Director.
v. Industry representative: One representative from industry/corporate sector/allied area relating to placement.
vi. Co-opt members: Chairman, BoS, may with the approval of the Director shall co-opt: Experts from outside the college whenever special courses of studies are to be formulated.
vii. Member secretary: Nominated by first year Programme coordinator.

The term of the nominated members shall be two years. Director shall draw the schedule for meeting of the Board of Studies for different departments. The meeting may be scheduled as and when necessary, but at least once a year.

***The Board of Studies of a department in the college shall:***

a. Review and revision of curriculum keeping in view the VMOs of the college and department, interest of the stakeholders, and national requirement for consideration.
b. Ensure academic standard and excellence of the courses offered by the department.
c. Recommend the curriculum for approval of the Academic Council.
d. Coordinate research, teaching, extension and other academic activities in the department/college.

## 15.5 Departmental Advisory Board (DAB)

DAB is another basic constituent of the academic system of an autonomous college. The composition and functions of the DAB are given below:

Composition:

i. Chairman: Head of the concerned department
ii. Internal members: Two senior faculty members of department.
iii. Industry representative: One representative from industry/corporate sector/allied area relating to placement.
iv. One academician outside college.
v. One meritorious alumnus.
vi. One parent.
vii. One student.
viii. Member secretary: Programme Evaluation Coordinator

The term of the nominated members shall be two years. Director shall draw the schedule for meeting of the DAB for different departments. The meeting may be scheduled as and when necessary, but at least once a year.

***The DAB of a department in the college shall:***

a. Formulate a process to review post-implementation effects of curriculum.
b. Suggest measures to ensure academic standard and excellence of the courses offered by the department.
c. Suggest methodologies for innovative teaching and evaluation techniques; enhancement of industry-institute interaction.
d. Identify and recommend the need of new programme.
e. Review target set for attainment of course outcomes and programme outcomes.
f. Guide and provide support to department for enhancing interaction with outside world.
g. Plan strategically to enhance the academic quality of department.
h. Address concerns of stakeholders expressed through feed back.
i. Defining and redefining the Programme Educational Objectives (PEOs) and Programme Outcomes (POs) based on the recommendations by departmental academic committee.
j. Study the achievement of PEOs and POs reported by department academic committee and suggest measures for improvement.

## 15.6 Board of Examinations (BoE)

Composition:

i. Director (Chairman)
ii. Dean Academics
iii. Controller of Examination (COE): Member Secretary
iv. University Nominee (COE of Shivaji University (SU) or his nominee not below the rank of Deputy Registrar)
v. One expert possessing ten years of industrial/field experience nominated by the Chairman.
vi. DPC Chairpersons (Representing DPC)
vii. Coordinators (Examination, Assessment, Results and Tabulation)

***Functions and Powers:***

a. The BoE shall
    i. Ensure proper performance of the various duties in conducting examinations viz. paper setting, time table preparation, assessment and declaration of results.
    ii. Recommend examination reforms and shall implement them after approval of academic council.
    iii. Prepare the detailed time table of examinations as per the schedule approved by academic council.
    iv. Arrange for strict vigilance during the conduct of examination so as to avoid use of unfair means by the students, faculty, and invigilators.
b. Chairman, BoE shall constitute Complaint Redressal Committee (CRC) consisting of three members as and when required to deal with the complaints related to the conduct of examinations.
c. The recommendations of the CRC shall be approved by Chairman, BOE to take appropriate disciplinary actions in the concerned matter. The disciplinary actions shall be endorsed by the BOE.
d. The BOE shall perform such duties and responsibilities that are assigned by Academic Council of the institute from time to time.

**15.7 Departmental Academic and Programme Evaluation Committee**

Composition:

i. Head of Dept. (Chairman)
ii. Five faculty members (at least one from each specialisation) nominated by HoD.
iii. Member Secretary: Programme Academic Coordinator (UG)/Programme Evaluation Coordinator (UG).

***Functions and Powers:***

a. Review, revise and prepare curriculum structure following institutional policy, suggest improvements in syllabus of a course/s prepared by course teacher/s, and forward the curriculum to BoS for further recommendation.
b. Check appropriateness of course objectives, course outcomes, and mapping of COs with POs and suggest necessary improvements/modifications.
c. Monitor the academic progress throughout the semester, conduct of classes, and take appropriate corrective measures to improve quality of curriculum delivery.
d. Review academic performance of students.
e. Counsel the concerned course teachers for improvement based on student feedback, academic and question paper audit reports.

f. Set target/s for attainment of course outcomes and programme outcomes.
g. Formulate strategy to collect feedback from stake holders, analyze the collected feedback and forward the analysis to DAB.
h. Contribute to maintain academic standard, improve quality of the courses offered by the department and enhancement of industry-institute interaction.
i. Suggest open and professional electives considering societal needs.
j. Recommend methodologies for innovative teaching and evaluation techniques to BoS.
k. Coordinate research, teaching, extension and other academic activities in the department/college.
l. Carry out preparatory work for defining/redefining the Programme Educational Objectives (PEOs) and Programme Outcomes (POs) periodically.
m. Monitor evaluation of course attainments leading to achievement of programme outcomes and report the results of assessment to BoS.

**15.8 Programme Academic Coordinator**

There shall be Programme Academic Coordinator for UG programme. The functions and duties are:

a. Coordination of all academic activities of the programme viz. curriculum revision, framing of syllabus, time table, BoS meeting as member secretary, re-registration of course/s, display and submission of attendance status.
b. Coordination for programme related examination activities (submission of ISE marks and question papers), Preparation of schedule of ESE for laboratory in coordination with examination cell.
c. Monitoring academic activities and conduct of classes.
d. Extend necessary help to departmental academic and programme evaluation committee.
e. Recording and forwarding all academic and examination related documents to Dean academics/CoE.
f. Work in association with Dean Academics and Controller of Examinations.

**15.9 Programme Evaluation Coordinator**

There shall be Programme Evaluation Coordinator for UG programme. The functions and duties PEC are:

a. Coordination to conduct internal academic audit, question paper audit, and departmental advisory board meetings as a member secretary.
b. Conduct course and graduate exit survey, make arrangements for feedback from stakeholders (industry/employer/alumni) and feedback analysis.
c. Monitoring assessment of course outcomes.
d. Computation/assessment/evaluation/achievement of PEOs and POs as per NBA requirements.
e. Compilation of information required for Annual Quality Assurance Report (AQAR) of the Internal Quality Assurance Cell (IQAC) and forwarding it to Dean QA.
f. Extend necessary help to departmental academic and programme evaluation committee.
g. Work in association with Dean QA.

PACUG and PECUG will coordinate NBA documentation activity.

**15.10 First Year Programme Coordinator (FYPC)**

There shall be FYPC and functions and duties are:

a) Coordination of all academic and examination (submission of ISE marks and question papers)activities of first year programme (excluding basic engineering courses) viz. curriculum revision, framing of syllabus, time table, BoS meeting as Chairman, re-registration of course/s, display and submission of attendance status.
b) Coordination to conduct internal academic and question paper audit.
c) Provide assessment of course outcomes to concerned departments and relevant information required for NBA documentation.
d) Monitoring academic activities and conduct of first year classes.
e) Work in association with Dean Academics.

**15.11 Faculty advisor /Mentor**

The faculty Advisor/Mentor will be appointed by the HoD of the parent department, who will be assigned a group (20 -25) of students of the concerned parent department, and will be valid throughout their duration of study. A group shall consist of 5-7 students from each class.

***The functions and duties of FA are:***

a. Help the students in planning their courses and related activities during their study period.
b. Monitor, guide, advice and counsel the students on *all* academic matters.
c. Interact with the students at least twice in a semester and maintain the records/minutes of meeting.

**15.12 Course teacher**

***The functions and duties of course teacher are:***

a. Conduct classes as per the time table issued by the HoD and maintain all academic records (Attendance on moodle, Evaluation, Attainment) for that course.
b. Prepare course delivery and evaluation plan for student performance and distribute to all the students within the first week of each semester.
c. Display students' performance in attendance and evaluation as stipulated in the academic RRs.
d. Report to the HOD on a periodic (*monthly*) basis, the potential cases of very poor academic performance as well as those of low attendance.
e. Submit ISE marks to PACUG as per the schedule in academic calendar.
f. Document all academic records in the course book in a format specified by Dean QA and submit it for academic audit.

## 16. DISCIPLINE AND CONDUCT

16.1 Any act of misconduct committed by a student inside or outside the campus shall be an act of violation of discipline of the college. Violations of the discipline shall include:

a. Disruption of teaching, examination, administrative work, curricular or extra-curricular activity, and any act likely to cause such disruption.
b. Damaging or defacing the property inside or outside the college campus.
c. Engaging in any attempt at wrongful confinement of teachers, offices, employees and students of the college.
d. Use of abusive and derogatory slogans or intimidatory language or incitement of hatred and violence.

e. Ragging in any form ("Ragging" means causing, inducing, compelling or forcing a student, whether by way of a practical joke or otherwise, to do any act which detracts from human dignity or violates his person or exposes him to ridicule or to forbear from doing any lawful act, by intimidating, wrongfully restraining, wrongfully confining or injuring him or by using criminal force to him or by holding out to him any threat of such intimidation, wrongful restraint, wrongful confinement, injury or the use of criminal offence. Supreme Court of India has defined ragging as a criminal offence.)
f. Eve teasing or disrespectful behaviour to women or girls students.
g. An assault upon, or intimidation of, or insulting behaviour towards a teacher, officer, employee or student or any other person.
h. Getting enrolled in more than one programme course of study simultaneously.
i. Committing forgery, tampering with documents or records, identity cards, furnishing false certificate or false information.
j. Organising instant agitation/meetings without prior permission in the campus.
k. Viewing/downloading obscene information/data, images and executable files, sending obscene mails/messages via facebook / tweeter/other social sites using college servers.
l. Sharing the login and passwords & other details of IT facilities provided to other students/outsiders.
m. Refusing to provide an identity card when demanded by any college authority.
n. Consuming or possessing alcoholic drinks, dangerous drugs or other intoxicants in the college campus.
o. Possessing or using any weapons and fire arms in the college campus.
p. Unauthorized occupation of hostel, Accommodating guests or other persons in hostels without permission.
q. Malpractice in examination.
r. indulging in anti-national activities contrary to the provisions of acts and laws enforced by Government.
s. Any other act which may be considered by the Director or the Discipline Committee to be an act of violation of discipline.

16.2 Any act of indiscipline of a student reported to Director/Concerned authority shall be referred to Grievance Redressal and Disciplinary Committee of the college. The Committee shall enquire into the charges and recommend suitable punishment if the charges are substantiated. The penalties/punishment/actions may include:

a. Written warning and information to the parents/guardian.
b. Imposition of fine ranging from Rs. 500/- upto Rs. 5000/-.
c. Suspension from the College/Hostel/Mess/Library/ or availing of any other facility.
d. Suspension or cancellation of scholarships/fellowship or any financial assistance from any source.
e. Recover of loss caused to college property.
f. Debarring from participation in sports/NSS/student club.
g. Disqualifying from holding any representative position in the Class/College/Hostel/Mess/Sports/Clubs and in similar other bodies.
h. Disqualifying from appearing in placement and receiving any awards.
i. Expulsion from the Hostel/Mess/Library/Club/College for a specified period by forfeiting fees.
j. Debarring from an examination.
k. Action as per Maharashtra anti-ragging act 1999.

16.3 If a student is found guilty of malpractice in examinations then he/she shall be punished as per the recommendations of the Complaint Redressal Committee (CRC) constituted by BoE. The CRC shall inquire and decide the punishment by following the Guidelines for imposing punishment on examinee/s/others involved in unfair means. However depending on the situation, committee may quantify the severity of the punishment which may include:

a. Cancellation of the performance of the student in the course/s in which he/she was involved in malpractice.

b. Cancellation of the performance in that examination for all the courses.

c. Expulsion/termination from the college if repeatedly involved.

d. Stoppage of scholarships/stipend.

e. Issuing warning.

f. Debarring from the examinations for a specified period.

16.4 Student/s involved in act of indiscipline/malpractice in examination shall be issued notice asking him/her asked to be present before the respective committee (GRDC/CRC) on the day at specified time and venue with his/her parents/guardian. He/she shall give written reply/oral explanation to the charges levelled against him/her for consideration. If the implicated student/s fails to appear before the committee, then decision shall be taken in absentia, on the basis of available evidence/documents, which shall be binding on the concerned student.

16.5 Every admitted student shall be issued photo identification (ID) card which must be retained by the student while he/she is registered at WCE. The student must have valid ID card with him/her while in the institute.

## 17. CONCLUSIONS

The academic policies/regulations regarding conduct of undergraduate programme in WCE are published in this document. The academic council reserves the right to modify these policies/regulations as and when required from the point of view of achieving academic excellence.

The decision of Director (Chairman, Academic council) shall be final and binding on all concerned i) for the cases not covered through this document; ii) in case of any dispute, difference of opinion in interpretation of this regulation; and iii) emergent cases.

Director

# Changes/Amendments in Academic Rules and Regulations [UG]

(After 6th and 7th Academic Council Meeting)

**Inclusions/Incorporations in academic rules and regulations (V1.6) of UG and PG**

(As per the decisions in 7th Academic Council meeting)

6.3

iv) The participation by a student at state/national level and bringing credit to institute is to be considered for exemption/excuse from attendance during the period of the concerned activity. The exemption/excuse is to be considered by assigning the same grade to exemption/excuse as that of present (Normally one grade) in moodle setting for attendance record.

9.14 The achievement by a student at state/national level and bringing credit to institute is to be considered for exemption from MSE. The performance in ESE by such student will be enhanced by 1.6 factor to compensate for exemption of MSE. However, such student should get minimum of 40% marks in ESE. In case ESE is missed, such student should appear for make-up examination. No remarks will be indicated in grade card.

10.22 (UG) and 10.24 (PG)

The rules for giving extra 3% marks (E3M) for Specially Abled students (SAS)

a. The E3M for SAS shall be given only for the first attempt.

b. The E3M shall not be applicable to SAS appearing for makeup examinations. However, if such a student, due to valid reasons, does not appear for any of the evaluation in all the courses during the regular semester and if he is permitted to appear in all the courses of the concerned semester during the makeup examination of that year, in such a case E3M shall be a valid claim to the concerned SAS.

c. The total of maximum marks of the semester, for which the SAS is appearing, shall be computed based on the current academic structure in force and excluding the backlog (re-registered) courses.

d. The courses, in which SAS has failed, shall be arranged in descending order based on the scored marks (The course with least marks required for passing will be first and so on).

e. Accordingly, the 3% marks shall be computed and distributed among the courses of above two groups so as to give marks required for passing subject to the condition that, the total extra marks shall not exceed 3% of the concerned semester total.

f. While giving extra marks, first the required marks shall be given to enable the student to pass ESE and then (if needed), the required marks for passing the course shall be given. However he/she shall be pass with passing grade “DD”.

g. To be eligible for these benefits, SAS must have appeared all components of evaluations for the course.

h. The course/s, for which SAS has availed this benefit, shall be indicated with (£ pound symbol) and mention of the GR will be made on the grade card.

## Amendments in UG and PG RRs

| CPI improvement | | |
|---|---|---|
| RR | Present | Amended |
| UG 10.21 iii. | A student who has passed final B. Tech. shall apply for CPI improvement within 15 days after declaration of makeup examination result. He/she shall re-register for the course/s of final and third year in which the student wants to apply for grade improvement. Such students shall return all the concerned original grade cards to CoE. | A student who has passed final B. Tech. may apply for CPI improvement. He/she shall re-register for the course/s of final and third year in which the student wants to apply for grade improvement. Such students shall return all the concerned original grade cards to CoE. |
| PG 10.23 iii. | A student who has passed M. Tech. shall apply for CPI improvement within 15 days after declaration of makeup examination result. He/she shall re-register for the course/s of first year in which the student wants to apply for grade improvement. Such students shall return all the concerned original grade cards to CoE. | A student who has passed M. Tech. may apply for CPI improvement. He/she shall re-register for the course/s of first year in which the student wants to apply for grade improvement. Such students shall return all the concerned original grade cards to CoE. |
| Passing Criteria/Grace Marks | | |
| UG PG 10.4 | A student will be given maximum of two grace marks per course to obtain passing grade in maximum of two courses provided he/she has passed in all other courses for that semester. If a student has failed in more than two courses, no grace marks will be applicable in any course. | A student shall be given maximum of two grace marks [(for ESE or (ISE1 +MSE+ISE2)] per course to obtain passing grade in maximum of two courses provided he/she has passed in all other courses for that semester. If a student has failed in more than two courses, no grace marks will be applicable in any course. |
| UG PG 10.6 | FF grade shall be assigned to a student in a theory course in the following cases;<br>i. Sum of marks obtained by the student in ISE-1, ISE-2, MSE, ESE, and grace (if any) is less than 40.<br>ii. Marks obtained in ESE are less than 20. | FF grade shall be assigned to a student in a theory course in the following cases;<br>i. Sum of marks obtained by the student in ISE 1, ISE 2, MSE, ESE, and grace (if any) is less than 40.<br>ii. Marks obtained in ESE are less than 20 (with grace if any). |

# Walchand College of Engineering, Sangli

(A Govt. Aided Autonomous Institute)

**1947**

# Credit System and Course Content

## Second Year B.Tech.

## Computer Science and Engineering

## Semester III and IV

### Academic Year 2020-21

# BoS Minutes

# WALCHAND COLLEGE OF ENGINEERING,

# SANGLI

## Department of Computer Science and Engineering

### Board of Studies Minutes of Meeting

Date of BoS: 14th May 2019

The BoS meeting was held on 14/05/2019 @10:30 AM in Database Engineering Lab. Following members were present:

**From CSE Dept WCE:** Dr. B. F. Momin, Dr. P. J. Kulkarni, Mr. M. K. Chavan, Mrs. M. A. Shah, Dr. N. L. Gavankar, Mr. A. R. Surve, Mrs. S. S. Solapure, Mrs. Hetal Gandhi, Mr. V. N. Honmane, Mr. N. K. Pikle, Mr. S. L. Mahadeshwar, Mr. K. P. Kamble, Mr. S. S. Sontakke, Mrs. N. L. Mudegol, Ms. A. V. Terkhedkar, Mr. S. M. Rathod, Miss. A. S. Pawar, Miss. P. D. Mundada.

**From outside of WCE:** Dr. G. A. Patil (D Y Patil, COE, Kolhapur), Dr. Mrs. Vrushali Kulkarni (MIT, Pune), Mr. Hemendra Singh Patel (JEC Jabalpur), Mr. R. S. Daboria (JEC Jabalpur).

**Invitee member:** Miss. M. B. Shinde (IT Dept. WCE), Mrs. B. S. Shetty (IT Dept. WCE).

With a detailed discussions in the meeting, following are the resolutions of the meeting:

A. BoS Minutes of the earlier meeting were read and confirmed. Regarding design of SY B.Tech syllabus revamping AICTE guidelines have been followed. A one day workshop for all internal faculty members of CSE Dept. was held on 16th March 2019 for guidance for defining Course outcomes and their mapping to program outcomes. There upon a detailed plan has been worked out for carrying out various activities. The plan of action has been finalized and detailed as follows:

Tentative Plan

| Activities | March | April | May | June |
|---|---|---|---|---|
| • Organizing workshops for faculty so as to implement AICTE model curriculum | √ | | | |
| • Deliberations on feasibility of implementing model curriculum and incorporating appropriate changes on the basis local needs. | √ | √ | √ | |
| • Identification of industry experts for formation of subject wise Industry Consultation Committee (ICC). | | √ | √ | |
| • Communication with identified members for their acceptance | | √ | √ | |

| Activities | March | April | May | June |
|---|---|---|---|---|
| • Formation of ICC. Functions: | | √ | √ | |
| ○ Revision of curriculum | | | | |
| ○ Vetting of PEO, PO, CO | | | | |
| ○ Activities for industry institute interaction | | √ | √ | |
| ○ Guidance/assistance on internships and placement | | | | |
| ○ Finishing courses: design and implementation | | √ | √ | |
| ○ Industry expert lectures, Student and faculty visits to industries | | √ | √ | |
| ○ Final year projects with sponsorships | | | | √ |
| ○ Collaborative research/consultancy for students and faculties | | | | √ |
| ○ Providing technical inputs to start-ups. | | | | √ |
| • Examining the existing curriculum for its suitability of industry demand. | | | | √ |

B. In the BoS meeting held today following points have been discussed:

1. Earlier BoS Minutes of Meeting was confirmed.
2. Regarding academic and evaluation reforms following points are discussed:
    a. ISE component has to be non-written.
    b. ISE should be based on active learning, oral, presentations, MCQ, flipped classroom modules (refer IIT teaching pedagogy course)
    c. Open book test can be part of ISE or MSE for selected courses which are selected by a committee formed by department which may include HoD, PACUG, PEC and some experts.
    d. ISE component should be of 30 marks.
    e. ISE can be based on problem solving in teams or solo based on self-study (content beyond syllabus), think-pair-share.
    f. Assignments based on six modules given to teams.
    g. MOOCs learning courses, paper presentations with certificate can be considered for ISE.
3. Regarding modification or incorporation of additional issues in the prevailing UG following points are discussed:
    a. For credit course it should be classroom based (Teacher Assisted) not totally based on MOOCs.
    b. Provision of 5 outside courses (external courses from SWAYAM/NPTEL) to be acknowledged on WCE grade card provided exam must be conducted by WCE.
    c. MOOCs course should be encouraged.
    d. At the start of semester course teacher has to inform department committee regarding open book test then committee will check CO-PO and take decision on conducting open book test.
4. Regarding finalization of Second Year Syllabus structure and syllabus contents following points are discussed:
    a. For **Applied Math's for CSE** subject, module 4, 5, and 6 should be based on case studies.
    b. Module 6 name should be revised as number theory.

c. Contents of data analytics prerequisites and advance topics on probability and statistics should be covered in Applied Maths.
d. For **Data Structure** subject sequence of modules should be revised.
e. Priority queue should be taken with min max heap.
f. Backtracking must be in design and algorithms subject.
g. Practical must be conducted using C programming.
h. Horowitz will be used for theory and Shaum series book may be used for lab session.
i. For **Data Communication** subject, module 5 & 6 should be merged as module 5 and new contents for module 6 should be created which are linked to Computer Network subject in the next semester.
j. Data Communication and Computer Network subjects include relevant mathematics as per GATE syllabus.
k. For **Computer Organization and Architecture** subject, 2 modules should be on organization and 4 modules on Architecture.
l. Module 1 renamed as introduction to computer organization.
m. Reduce contents of 8085 and focus more on 8086 interfacing.
n. Module 2 is on 8085, 3 is on 8086, 4 is on data representation, 5 on interfacing and last 6th module is on ARM processor.
o. For **Programming Laboratory 1**, first 2 modules are based on C++ and remaining modules are on Python.
p. For **Software Engineering** subject two textbooks should not be of same author.
q. For **Formal Language and Automata Theory** subject add textbook by Cohen.
r. For **Operating System** subject 4 modules are related to general OS and 2 modules are specific to some OS.
s. Add latest textbooks, and add case studies.
t. For **Database Engineering** subject add reference book by Vipin Desai.
u. For **Computer Network** subject add last module based on queueing theory.
v. Add network layer related numerical and prepare contents based on GATE syllabus.

5. Following Program Specific Outcomes are revised:
   a. PSO1: apply knowledge in relevant domains of computer science and engineering to solve real life problems.
   b. PSO2: adapt to modern computing technology for industry readiness, higher studies and entrepreneurship.
6. Following List was suggested for Courses to be offered for Minor Degree in Computer Science & Engineering:
   a. Programming Language
   b. Data Structure
   c. Database Engineering
   d. Operating System
   e. Computer Networks
   f. Web Technology
7. Regarding Final Year structure it is suggested that, two elective courses plus one audit course will be heavy for last semester considering internship of the students.
8. The meeting was ended with vote of thanks.

The Chairman, BoS (CSE)
Date: 14th May 2019

# Credit System and Evaluation Scheme

# Walchand College of Engineering, Sangli.

(An Autonomous Institute)

Teaching and Evaluation Scheme effective from 2020-2021

## Second Year B. Tech. Program in Computer Science and Engineering

Semester I

| Sr.No. | AICTE Category | Course Code | Course Name | L | T | P | Hrs | Credits | ISE-1 | MSE* | ISE-2 | ESE |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Professional Core (Theory)** | | | | | | | | | | | | |
| 1 | BS | 5MA201 | Probability and Statistics | 2 | 0 | 0 | 2 | 2 | 10 | 30 | 10 | 50 |
| 2 | PC | 5CS202 | Discrete Mathematics | 3 | 0 | 0 | 3 | 3 | 10 | 30 | 10 | 50 |
| 3 | PC | 5CS203 | Data Structures | 3 | 0 | 0 | 3 | 3 | 10 | 30 | 10 | 50 |
| 4 | PC | 5CS204 | Data Communication | 3 | 0 | 0 | 3 | 3 | 10 | 30 | 10 | 50 |
| 5 | PC | 5CS205 | Computer Organization and Architecture | 3 | 0 | 0 | 3 | 3 | 10 | 30 | 10 | 50 |
| 6 | PC | 5CS206 | Software Engineering | 3 | 0 | 0 | 3 | 3 | 10 | 30 | 10 | 50 |
| **Professional Core (Lab)** | | | | | | | | | | | | |
| 7 | PC | 5CS251 | Programming Lab 1 | 0 | 0 | 2 | 2 | 1 | 25 | 25 | 25 | 25 |
| 8 | PC | 5CS253 | Data Structures Lab | 0 | 0 | 2 | 2 | 1 | 25 | 25 | 25 | 25 |
| 9 | PC | 5CS255 | Computer Organization and Architecture Lab | 0 | 0 | 2 | 2 | 1 | 25 | 25 | 25 | 25 |
| **Value Added Professional Courses #** | | | | | | | | | | | | |
| 10 | VAPC | Refer list | Value Added Professional Courses | | | | 2 | # 2 | | | | |
| **Value Added Life-Skill Courses #** | | | | | | | | | | | | |
| 11 | VALS | Refer list | Value Added Life Skill Courses | | | | 2 | # 2 | | | | |
| | | | **Total** | **17** | **0** | **6** | **23** | **20** | | | | |

# Walchand College of Engineering, Sangli

(An Autonomous Institute)

Teaching and Evaluation Scheme effective from 2020-2021

## Second Year B. Tech. Program in Computer Science and Engineering

Semester II

| Sr.No. | AICTE Category | Course Code | Course Name | L | T | P | Hrs | Credits | ISE-1 | MSE* | ISE-2 | ESE |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Professional Core (Theory)** | | | | | | | | | | | | |
| 1 | BS | 5CS221 | Applied Mathematics for Computer Science and Engineering | 3 | 0 | 0 | 3 | 3 | 10 | 30 | 10 | 50 |
| 2 | PC | 5CS222 | Formal Language and automata theory | 3 | 1 | 0 | 4 | 4 | 10 | 30 | 10 | 50 |
| 3 | PC | 5CS223 | Operating Systems | 3 | 0 | 0 | 3 | 3 | 10 | 30 | 10 | 50 |
| 4 | PC | 5CS224 | Database Engineering | 3 | 0 | 0 | 3 | 3 | 10 | 30 | 10 | 50 |
| 5 | PC | 5CS225 | Computer Network | 3 | 0 | 0 | 3 | 3 | 10 | 30 | 10 | 50 |
| **Professional Core (Lab)** | | | | | | | | | | | | |
| 6 | PC | 5CS274 | Database Engineering Lab | 0 | 0 | 2 | 2 | 1 | 25 | 25 | 25 | 25 |
| 7 | PC | 5CS275 | Computer Network Lab | 0 | 0 | 2 | 2 | 1 | 25 | 25 | 25 | 25 |
| 8 | PC | 5CS276 | Programming Lab 2 | 0 | 0 | 2 | 2 | 1 | 25 | 25 | 25 | 25 |
| 9 | HS | 5CS277 | Presentation and Report Writing | 0 | 1 | 0 | 1 | 1 | 25 | 25 | 25 | 25 |
| **Mandatory Life Skill Courses** | | | | | | | | | | | | |
| 10 | HS | 5IC201 | Environmental Sciences | 2 | 0 | 0 | 2 | 0 | 10 | 30 | 10 | 50 |
| **Value Added Professional Courses** | | | | | | | | | | | | |
| 11 | VAPC | Refer list | Value Added Professional Courses | | | | 2 | # 2 | | | | |
| **Value Added Life-Skill Courses** | | | | | | | | | | | | |
| 1 | VALS | Refer list | Value Added Life Skill Courses | | | | 2 | # 2 | | | | |
| | | | **Total** | **17** | **2** | **6** | **25** | **20** | | | | |

**Walchand College of Engineering, Sangli**
(An Autonomous Institute)
**Curriculum Structure for Minor in Computer Science and Engineering**

| Semester | Course Code and Course Title% | Credits$ | Course Availability: SWAYAM/NPTEL Instructor* | SWAYAM/NPTEL Link& | WCE@ | Course Evaluation# |
|---|---|---|---|---|---|---|
| | **Group A (Mandatory courses) Total Credits : 12** | | | | | |
| **III** | 1CSM01<br>Data structures | 3 | Dr. N. L. Gavankar | NA | Data structures 4CS203 | WCE |
| **IV** | 1CSM02<br>Software Engineering | 3 | Mr.A.R. Surve | NA | Software Engineering 4CS221 | WCE |
| **V** | 1CSM03<br>Database Engineering | 3 | To be specified | NA | Database Engineering 4CS224 | WCE |
| **VI** | 1CSM04<br>Computer Networks | 3 | To be specified | NA | Computer Network 4CS225 | WCE |
| | **Group B (Elective courses, Seminar, Mini-project, Project) Total Credits : 8** | | | | | |
| **VII**<br>*(one course of three credits and one course of two credits should be opted for semester VII)* | 1CSM21<br>Machine Learning | 2 | To be specified in June 2021 | To be specified in June 2021 | NA | WCE (SWAYAM course evaluated at WCE) |
| | 1CSM22<br>Cloud Computing | 2 | | | NA | WCE (SWAYAM course evaluated at WCE) |
| | 1CSM23<br>Cyber security | 3 | | | NA | WCE (SWAYAM course evaluated at WCE) |
| | 1CSM24<br>Ethical Hacking | 3 | | | NA | WCE (SWAYAM course evaluated at WCE) |

| | | | | | | |
|---|---|---|---|---|---|---|
| VIII *(one course from three options should be opted for semester VIII)* | 1CSM51 Internet of Things | 3 | To be specified in December 2021 | To be specified in December 2021 | NA | WCE (SWAYAM course evaluated at WCE) |
| | 1CSM52 Natural Language Processing | 3 | | | NA | WCE (SWAYAM course evaluated at WCE) |
| | 1CSM53 Computer vision | 3 | | | NA | WCE (SWAYAM course evaluated at WCE) |

| **Semester** | **III** | **IV** | **V** | **VI** | **VII** | **VIII** | **Total** |
|---|---|---|---|---|---|---|---|
| **Credits** | **3** | **3** | **3** | **3** | **5** | **3** | **20** |

# ODD Semester

# ODD Semester

# Professional Core (Theory) Courses

| **Title of the Course: Probability and Statistics**<br>**Course Code: 5MA201** | L | T | P | Cr |
|---|---|---|---|---|
| | 2 | 0 | 0 | 2 |

**Desirable requirements:**

**Textbooks:**

**Textbooks:**

1.

**References:**

1.

**Course Objectives:**

1. .

**Course Learning Outcomes:**

| CO | After the completion of the course the student should be able to | Bloom's Cognitive | |
|---|---|---|---|
| | | level | Descriptor |
| CO1 | | | |
| CO2 | | | |
| CO3 | | | |

**CO-PO Mapping :**

| PO and PSO | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | | | | | | | | | | | | | | |
| CO2 | | | | | | | | | | | | | | |
| CO3 | | | | | | | | | | | | | | |

*1: Low, 2: Medium, 3: High*

**Assessments :**

**Teacher Assessment:**

Two components of In Semester Evaluation (ISE), One Mid Semester Examination (MSE) and one End Semester Examination (ESE) having 20%, 30% and 50% weights respectively.

| | |
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ISE 1 and ISE 2 are based on assignment/declared test/quiz/seminar/oral etc.

MSE: Assessment is based on 50% of course content (Normally first three modules)

ESE: Assessment is based on 100% course content with 70-80% weightage for course content (normally last three modules) covered after MSE.

**Course Contents:**

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**Module wise Measurable Students Learning Outcomes :**

-

| **Title of the Course: Discrete Mathematics**<br>**Course Code**: **5CS202** | L | T | P | Cr |
|---|---|---|---|---|
| | 3 | 0 | 0 | 3 |

**Desirable requirements:** Mathematics-(set theory, Boolean operations, logical operations)

**Textbooks:**

1. J.P. Tremblay &R. Manohar , *"Discrete Mathematical structure with applications to computer"*, McGraw Hill,1st Edition, 2001
2. Liu, *"Elements of Discrete Mathematics"*, Tata McGraw Hill,3rd edition 2008
3. Kenneth Rosen, "Discrete Mathematics & its application" McGraw Hill, 7th edition 2012.

**References:**

1. K.D. Joshi, *"Foundation of Discrete Mathematics"*, New Age International Ltd,1st edition,2014
2. Seymour Lipschutz , Marc Lipson *"Discrete Mathematics: Schaum's Outlines Series"*, Schaum's outline series.,3rd edition, 2009

**Course Objectives :** This subject enhances one's ability to reason and ability to present a coherent and mathematically accurate argument. About 30% of the course time will be spent on logic, set theory, counting techniques and remaining 60% of the course time will be devoted to functions, relations, algebraic structures, graph theory, permutation and combination. Objectives of this course are as follows:

1. Deliver basic concepts of Logic theory to solve real life problems.
2. Introduce graphs, trees and algebraic structure and develop an attitude to solve problems based on these topics.
4. To give deep insight into discrete probability and combinatorics.

**Course Learning Outcomes:**

| **CO** | **After the completion of the course the student should be able to** | Bloom's Cognitive | |
|---|---|---|---|
| | | level | Descriptor |
| **CO1** | **Explain** logical notation to define and reason about fundamental mathematical concepts of logic theory, set theory, relations, probability, counting techniques. | 2 | Understanding |
| **CO2** | **Demonstrate** knowledge and skills obtained to investigate and solve problems of POSET, Hasse diagram, groups, semi group and monoid. | 3 | Applying |
| **CO3** | **Analyse** concepts and algorithms of graph theory and elementary combinatorial processes such as permutations and combinations. | 4 | Analysing |

**CO-PO Mapping :**

| **PO and PSO** | **PO1** | **PO 2** | **PO 3** | **PO 4** | **PO 5** | **PO 6** | **PO 7** | **PO 8** | **PO 9** | **PO 10** | **PO 11** | **PO 12** | **PSO1** | **PSO2** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | **3** | **2** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **1** | **-** |
| **CO2** | **3** | **2** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **1** | **-** |
| **CO3** | **2** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **1** | **-** |

*1: Low, 2: Medium, 3: High*

**Assessments :**

**Teacher Assessment:**

Two components of In Semester Evaluation (ISE), One Mid Semester Examination (MSE) and one End Semester Examination (ESE) having 20%, 30% and 50% weights respectively.

| Assessment | Marks |
|---|---|
| ISE 1 | 10 |
| MSE | 30 |
| ISE 2 | 10 |

| | |
|---|---|
| ESE | 50 |

ISE 1 and ISE 2 are based on quiz/assignments.
MSE: Assessment is based on 50% of course content (Normally first three modules)
ESE: Assessment is based on 100% course content with 70-80% weightage for course content (normally last three modules) covered after MSE.

**Course Contents:**

| **Module 1 Mathematical Logic & Set Theory** | **6 Hrs.** |
|---|---|
| Introduction, Statement and Notation, Connectives, statements formulas and truth tables, well-formed formulas, Tautologies Equivalence of formulas, Tautologies, other connectives, Normal & Principal Normal forms. Basic concepts of set theory, Venn Diagram, set operation, algebra of sets. | |
| **Module 2 Relations and Functions** | **7 Hrs.** |
| Relations, Pictorial representation of Relations, Properties of binary relation, Equivalence Relations, partition and covering of set, POSET and Hasse Diagram, Functions - types, Inverse and composition of functions, lattice. | |
| **Module 3 Algebraic structures** | **6 Hrs.** |
| Introduction, Operations, semigroups, Groups, subgroups, Rings, monoid. | |
| **Module 4 Graph theory and its applications** | **7 Hrs.** |
| Basic terminology, multigraphs and weighted graphs, Paths and Shortest path in weighted graphs, Hamiltonian and Eulerian Paths and Circuits, Factor of a graph, Planner Graph. | |
| **Module 5 Directed graphs** | **6 Hrs.** |
| Trees, Rooted Trees, Path lengths in rooted trees, Prefix codes, Binary search trees, Spanning trees and cut sets, Minimal spanning trees, Kruskal's algorithm and Prim's algorithms, Warshall's algorithm for transitive closure. | |
| **Module 6 Permutation, Combination and Discrete Probabilities** | **7 Hrs.** |
| Basic counting techniques – inclusion and exclusion, Rules of sum and product, permutations, combinations, generation of permutations and combinations, Introduction to Discrete Probability, entropy and mutual information, recursion. | |

**Module wise Measurable Students Learning Outcomes :**
**After the completion of the course the student should be able to:**

**Module 1:**
- Able to construct and explain logical proofs as logic plays a major role in formal languages and in hardware and software.

**Module 2:**
- Grasp concepts of relations and functions and demonstrate skills to solve related problems.

**Module 3:**
- Identify different algebraic structures

**Module 4:**
- Apply graph application in computer domain- e.g. finding shortest path in networking etc.

**Module 5:**
- Analyse concepts of trees, minimum cost spanning trees using different types of algorithms.

**Module 6:**
- Solve problems on permutation, combination and probability.

| Title of the Course: Data Structures<br>Course Code: 5CS203 | L | T | P | Cr |
|---|---|---|---|---|
| | 3 | 0 | 0 | 3 |

**Desirable requirements:** Programming in C including pointers and File Handling

**Textbooks:**

1. Richard F. Gilberg, Behrouz A. Forouzan, "Data Structures, A Pseudocode Approach With C",Cengage Learning, Second Edition, 2014
2. S. Lipschutz, "Data Structures,Schaum's" Outlines Series, Tata McGraw-Hill, 2013
3. Ellis Horowitz, S. Sahni, D. Mehta, "Fundamentals of Data Structures in C++", Galgotia Book Source, New Delhi, 2008

**References:**

1. Yashavant Kanetkar, "Understanding pointers in C", BPB Publication, 4th Edition, 2009
2. N. B. Venkateshwarlu, E. V. Prasad, "C and Data Structures", S. Chand and Company, 2010
3. Jean-Paul Tremblay, Paul. G. Soresan, "An introduction to data structures with Applications", Tata Mc-Graw Hill International Editions, 2nd edition, 1984

**Course Objectives :**

This course is one of the core subject for Computer Science and Engineering students. The course mainly focuses on introducing various linear and nonlinear data structures, their characteristics and applications. The insight knowledge of various searching and sorting techniques enables the students to identify and apply suitable technique for different applications.

1. To make the students understand elementary linear and non-linear data structures and concepts of ADTs.
2. To develop and improve logical thinking and to make the students capable of applying appropriate data structure for modelling a given problem.
3. To provide a foundation to analyse and compare various searching and sorting techniques and to select appropriate technique to solve the problem.

**Course Learning Outcomes:**

| CO | After the completion of the course the student should be able to | Bloom's Cognitive | |
|---|---|---|---|
| | | level | Descriptor |
| CO1 | **Explain** the fundamental concepts of structuring, managing and organizing the data using linear and non-linear data structures with ADTs, write recursive algorithms and explain various searching and sorting techniques | 2 | Understanding |
| CO2 | **Choose** suitable data structure to be used and apply it to solve the various problems | 3 | Applying |
| CO3 | **Compare** and **Analyze** various algorithms, searching and sorting methods based on inherent properties of data structures and the complexity of algorithms. | 4 | Analyzing |

**CO-PO Mapping :**

| PO and PSO | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CO2 | 3 | 3 | 2 | - | - | - | - | - | - | - | - | - | 3 | - |
| CO3 | 3 | 3 | 2 | - | - | - | - | - | - | - | - | - | 3 | - |

*1: Low, 2: Medium, 3: High*

**Assessments :**

**Teacher Assessment:**

Two components of In Semester Evaluation (ISE), One Mid Semester Examination (MSE) and one End Semester Examination (ESE) having 20%, 30% and 50% weights respectively.

| Assessment | Marks |
|---|---|
| ISE 1 | 10 |

| | |
|---|---|
| MSE | 30 |
| ISE 2 | 10 |
| ESE | 50 |

ISE 1 and ISE 2 are based on declared test/quiz/seminar
MSE: Assessment is based on 50% of course content (Normally first three modules)
ESE: Assessment is based on 100% course content with 70-80% weightage for course content (normally last three modules) covered after MSE.

**Course Contents:**

| **Module 1: Introduction** | **6 Hrs.** |
|---|---|
| **Basic Concepts:** Algorithm, Pseudocode, ADT, Data Structure, Algorithmic Efficiency<br>**Recursion:** Direct and Indirect recursion, analysis of recursive functions e.g. Towers of Hanoi, Ackerman's function, etc. | |
| **Module 2: Linked Lists** | **6 Hrs.** |
| Concept of linked organization, Singly linked list, doubly linked list and dynamic storage management, circular linked list, Operations such as insertion, deletion, inversion, concatenation, computation of length, traversal on linked list, Representation and manipulations of polynomials using linked lists. | |
| **Module 3: Stacks and Queues** | **6 Hrs.** |
| Fundamentals stack and queue as ADT, Representation and Implementation of stack and queue using sequential and linked organization, Circular queue: representation and implementation, Application of stack for expression evaluation and for expression conversion, Backtracking, Stacks and Recursion, Priority queue Doubly Ended Queue. | |
| **Module 4: Trees** | **7 Hrs.** |
| Basic terminology, binary trees and its representation, binary tree traversals (recursive and non-recursive), operations such as copy, equal on binary tree, expression trees, AVL Tree, Binary Search Trees, Heaps and its operations, Introduction to Multiway Trees. | |
| **Module 5: Graphs** | **5 Hrs.** |
| Terminology and Representation of graphs using adjacency matrix, adjacency list and adjacency Multilist, Traversals Depth First and Breadth First, Minimum Spanning Tree. | |
| **Module 6: Searching & Sorting Technique** | **9 Hrs.** |
| **Search:** Importance of searching, Sequential, Binary, Fibonacci search algorithms<br>**Sorting:** Internal and External Sorts**,** Insertion, Shell, Heap, Quick sort, Merge sort, Radix sort, Two-way merge sort<br>**Hashing:** Hashing functions, overflow handling with and without chaining, open addressing: linear, quadratic, double, rehashing<br>**Introduction to Files and Indexes** (concept only implementation not expected): Indexing Techniques: hashed indexes, Tree indexing - B-trees File Organizations: Sequential, Random and Linked organizations. | |

**Module wise Measurable Students Learning Outcomes :**
**After the completion of the course the student should be able to:**

**Module 1:**
- Explain ADT, build logic to solve the problem, write algorithms and think recursively.

**Module 2:**
- Apply concept of linked list and use of ADTs to solve the problem

**Module 3:**
- Choose data structures such as stacks and queues as the programmers' tool to solve problems.

**Module 4:**
- Apply non-linear data structure, tree and its basic operations and use it to solve the problem.

**Module 5:**
- Explain and use graph as a data structure to store and manipulate data for various applications

**Module 6:**
- Explain hashing, file organizations and compare various searching and sorting techniques.

| **Title of the Course: Data Communication**<br>Course Code: **5CS204** | L | T | P | Cr |
|---|---|---|---|---|
| | 3 | 0 | 0 | 3 |

**Desirable Requirements :** Nil

**Textbooks:**
1. Behrouz A. Forouzan, "Data communication and Networking", Tata McGraw-Hill, 4th/5th Edition, 2017.
2. William Stallings, "Data and Computer Communications", Prentice Hall(PHI) , 8th /9th Edition, 2010/2011

**References:**
1. James F. Kurose and Keith W. Ross, "Computer Networking: A Top-Down Approach Featuring the Internet", Pearson Education,5th /7th edition, 2012/2016

**Course Objectives:** The objective of the course is to provide a foundation and clear understanding of various concepts of data communication which will form basis of computer networking. Objectives are further divided as:
1. To elaborate various features and operations of data communication.
2. To inculcate protocol functions and issues related to Data Link layer.
3. To introduce the design and configuration of various networking techniques.

**Course Learning Outcomes:**

| **CO** | **After the completion of the course the student should be able to** | Bloom's Cognitive | |
|---|---|---|---|
| | | level | Descriptor |
| **CO1** | **Describe** fundamental concepts of data communication system. | 2 | Understanding |
| **CO2** | **Interpret** various concepts related to data link layer protocols. | 3 | Applying |
| **CO3** | **Differentiate** and **analyze** various data communication techniques | 4 | Analyzing |

**CO-PO Mapping :**

| **PO and PSO** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | **1** | **1** | - | - | - | - | - | - | - | - | - | - | - | - |
| **CO2** | **1** | **2** | - | - | - | - | - | - | - | - | - | - | **1** | - |
| **CO3** | - | - | **1** | - | - | - | - | - | - | - | - | - | - | - |

*1: Low, 2: Medium, 3: High*

**Assessments :**

**Teacher Assessment:**

Two components of In Semester Evaluation (ISE), One Mid Semester Examination (MSE) and one End Semester Examination (ESE) having 20%, 30% and 50% weights respectively.

| Assessment | Marks |
|---|---|
| ISE 1 | 10 |
| MSE | 30 |
| ISE 2 | 10 |
| ESE | 50 |

ISE 1 and ISE 2 are based on assignment/declared test/quiz/seminar etc.
MSE: Assessment is based on 50% of course content (Normally first three modules)
ESE: Assessment is based on 100% course content with 70-80% weightage for course content (normally last three modules) covered after MSE.

**Course Contents:**

| **Module 1: Introduction** | **4 Hrs.** |
|---|---|
| A Communications Model, Data Communications, Networks, The Internet-An Example Configuration. Data communication Concepts and Terminology: Analog and Digital Data Transmission, Transmission Impairments, Channel Capacity. Media: Guided Transmission Media, Wireless Transmission, Wireless Propagation, Line-of-Sight Transmission Types of electronics communication, Electromagnetic spectrum, Bandwidth, Signal Types, Noise: internal, External, Noise calculation. | |
| **Module 2: Encoding techniques** | **8 Hrs.** |
| Digital Data- Digital Signals, Digital Data- Analog Signals, Analog Data- Digital Signals, Analog Data- Analog Signals. Digital data communication techniques:- Asynchronous and Synchronous Transmission, Types of Errors, Error Detection & Correction, Hamming Code, CRC, Checksum, Line Configurations, Numerical problems on encoding. | |
| **Module 3: Multiplexing** | **8 Hrs.** |
| Frequency Division Multiplexing, Synchronous Time Division Multiplexing, Statistical Time Division Multiplexing, Pulse code modulation, Delta modulation, Adaptive delta modulation, Differential PCM, PAM. Spread Spectrum: The Concept of Spread Spectrum, Frequency-Hopping Spread Spectrum, Direct Sequence Spread Spectrum, Code Division Multiple Access. | |
| **Module 4: Switching techniques** | **8 Hrs.** |
| Switched Communications Networks, Circuit-Switching Networks, Circuit-Switching Concepts, Soft switch Architecture, Packet-Switching Principles, X.25, and Frame Relay. Introduction to Asynchronous Transfer mode protocol Architecture, Logical Connections, ATM Cells, Routing in Arpanet. | |
| **Module 5: Congestion control** | **5 Hrs.** |
| Effects of Congestion, Congestion Control, Traffic Management, Frame Relay Congestion Control. Cellular wireless network: Principles of Cellular Networks, First-Generation Analog Second-Generation CDMA, Third-Generation Systems. | |
| **Module 6: Flow Control and Internet Reference Models** | **6 Hrs.** |
| Framing –Fixed, Variable error control, Flow control, Simplest Protocols, Stop & Wait Protocols, GO Back N & Selective Repeat Sliding window protocols, Numerical problems on flow control techniques, other Protocols. Internet and Reference models-OSI, TCP/IP. | |

**Module wise Measurable Students Learning Outcomes :**

**After the completion of the course the student should be able to:**

**Module 1 :**

- Describe Data Communication model and various media for communication

**Module 2 :**

- Differentiate different encoding techniques.
- Apply error control techniques.

**Module 3 :**

- Differentiate and analyze various multiplexing techniques.

**Module 4 :**

- Distinguish between different switching techniques.

**Module 5 :**

- Identify and describe congestion control mechanisms and cellular wireless network.

**Module 6 :**

- Describe and differentiate various flow control techniques.

**Title of the Course: Computer Organization and Architecture**
Course Code : **5CS205**

| L | T | P | Cr |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**Desirable requirements:** Basic Electronics Engineering

**Textbooks:**

1. William Stallings, "Computer Organization and Architecture: Designing for Performance", Pearson Education, $8^{th}$ Edition/$10^{th}$ Edition, 2010/2016
2. Ramesh S. Gaonkar, "Microprocessor architecture, programming & applications", Penram International publications (India) Pvt. Ltd, $6^{th}$ edition, 2013
3. N. Senthil Kumar, M. Saravanan, S. Jeevanathan, S. K. Shah, "Microprocessors and Interfacing", Oxford Higher Education, $1^{st}$ Edition, 2012

**References:**

1. David A. Patterson and John L. Hennessy "Computer Organization and Design: The Hardware/Software Interface", Elsevier, 5th Edition, 2013
2. Ram, "Fundamentals of Microprocessors and Microcontrollers", Dhanpat Rai Publications, $1^{st}$ edition, 2012
3. ARM Based Development course, NPTEL(https://nptel.ac.in/courses/117106111/)

**Course Objectives:** The main objective of this course is to introduce and provide insights regarding different organizations and architectures of computer. The objectives are further divided as:

1. To introduce organization and architecture of computer.
2. To provide a foundation to write an 8 bit microprocessor program using assembly language.
3. To infuse understanding of usefulness X-86 microprocessor family and other processors and fundamental principles of ARM processors.

**Course Learning Outcomes:**

| **CO** | **After the completion of the course the student should be able to** | Bloom's Cognitive | |
|---|---|---|---|
| | | level | Descriptor |
| **CO1** | **Describe** basic concepts of the organization and architecture of computer and interfacing with external devices. | 2 | Understanding |
| **CO2** | **Illustrate** the knowledge gained about the data representation, internal organization, addressing modes, instruction set of 8085, 8086 and ARM processor for assembling language programming. | 3 | Applying |
| **CO3** | **Analyze** the working of processors like 8085,8086,ARM and interfacing of external devices like memory and I/O. | 4 | Analyzing |

**CO-PO Mapping :**

| **PO and PSO** | **PO 1** | **PO 2** | **PO 3** | **PO 4** | **PO 5** | **PO 6** | **PO 7** | **PO 8** | **PO 9** | **PO 10** | **PO 11** | **PO 12** | **PSO1** | **PSO2** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | **3** | **1** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **2** | **-** |
| **CO2** | **2** | **2** | **2** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **3** | **-** |
| **CO3** | **3** | **2** | **2** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **3** | **-** |

*1: Low, 2: Medium, 3: High*

**Assessments :**
**Teacher Assessment:**
Two components of In Semester Evaluation (ISE), One Mid Semester Examination (MSE) and one End Semester Examination (ESE) having 20%, 30% and 50% weights respectively.

| Assessment | Marks |
|---|---|
| ISE 1 | 10 |
| MSE | 30 |

| | |
|---|---|
| ISE 2 | 10 |
| ESE | 50 |

ISE 1 and ISE 2 are based on assignment/declared test/quiz/seminar etc.
MSE: Assessment is based on 50% of course content (Normally first three modules)
ESE: Assessment is based on 100% course content with 70-80% weightage for course content (normally last three modules) covered after MSE.

**Course Contents:**

| | |
|---|---|
| **Module 1: Introduction to Computer Organization** | **6Hrs.** |
| Introduction to Computer Organization and architecture, A brief history of computers, Von Neumann Architecture, designing for performance, Multicore, MICs and GPGPUs, Two Laws that Provide Insight: Amdahl's Law and Little's, Basic Measures of Computer Performance: Clock Speed, Instruction Execution Rate. Top level view of computer function and evolution: Computer Components, Computer Function, Interconnection Structures, Bus Interconnection, Point-to-Point Interconnect, PCI Express. | |
| **Module 2: Data Representation and Computer Arithmetic** | **6Hrs.** |
| The Arithmetic and Logic Unit, Integer Representation, Integer Arithmetic, Floating-Point Representation, Floating-Point Arithmetic, Programmable Logic Devices. | |
| **Module 3: 8085 Microprocessor** | **8Hrs.** |
| CPU organization, Microprocessors, Machine language, Assembly Language, Computer classification, Microprocessor Architecture, microcomputer systems; Single chip microcomputer: Microcontrollers, The 8085 microprocessor, machine cycles, 8085 Programming model, Instruction classification, Instruction Data format and storage, 8085 Instructions: Data transfer operations, Arithmetic operations, Logic operations, Branch operations. | |
| **Module 4: X-86 microprocessor Family** | **7Hrs.** |
| Microprocessor Architecture -8086, Register organization of 8086, Signal descriptions of 8086 chip, Physical Memory organization, Introduction to Maximum and Minimum mode operation, Addressing Modes, Co-processor configuration, interfacing of Co-processor with 8086. | |
| **Module 5: Interfacing of Memory & Input / Output Devices** | **7Hrs.** |
| Memory mapped I/o and I/O mapped I/O. Address decoding, interfacing of memory chips with 8085. Interfacing of interrupt controller with 8085, Programmable Interrupt Controller (8259A). Direct Memory Access (DMA), Stacks and subroutines. | |
| **Module 6: Introduction to ARM Processor** | **6Hrs.** |
| Arm core dataflow model, Registers, Current program status register, Pipeline, Exception, interrupt and vector table, Core extensions, Arm processor families, Data processing instruction and Arithmetic instruction. | |

**Module wise Measurable Students Learning Outcomes :**
**After the completion of the course the student should be able to:**

**Module 1:**
- Describe different computer components.
- Illustrate Basic Measures of Computer Performance and its use.

**Module 2:**
- Illustrate computer arithmetic with examples.

**Module 3:**
- Describe the basics of microprocessors and analyze difference between the machine language and assembly language of a computer.
- Describe the peculiarities of the instructions as to their category, word size, machine cycles for execution, addressing mode etc.

**Module 4:**
- Illustrate the basics of X-86 family microprocessors and describe the functions of each of its components.

**Module 5:**
- Describe the interfacing between microprocessor and various peripherals.

**Module 6:**
- Illustrate ARM processor family using assembly instructions and their formats and usage.

| Title of the Course: Software Engineering<br><br>Course Code: **5CS206** | L | T | P | Cr |
|---|---|---|---|---|
| | 3 | 0 | 0 | 3 |

**Desired requirements:**

**Textbooks:**

1. Pankaj Jalote, "An Integrated Approach to Software Engineering", Narosa Publishers, 3rd Edition, 2005.
2. Ian Sommerville, "Software Engineering", Addison-Wesley, 7th Edition, 2004.
3. James Rumbaugh, "Object Oriented Modeling and Design with UML", Pearson, 2nd Edition, 2004.

**References:**

1. Roger S. Pressman, *"Software Engineering: Practitioner's Approach"*, McGraw Hill, 7th Edition, 2010.
2. Jawadekar W.S., *"Software Engineering: principles and practices"*, Tata McGraw Hills, 1st Edition.
3. Gillies A.C. and Smith p., *"Managing Software Engineering: CASE studies and solutions"*, Chapman and Hall, London.

**Course Objectives :**

1. To unleash the orientation & importance of engineering approach to software development.
2. To infuse the knowledge of software processes & models practiced at IT industries.
3. To acquaint students with the SDLC phases in detail.
4. To emphasize on Design aspect with UML technology.
5. To inculcate the importance of software quality by virtue of software testing methods.

**Course Learning Outcomes:**

| CO | After the completion of the course the student Learner be able to | Bloom's Cognitive | |
|---|---|---|---|
| | | level | Descriptor |
| **CO1** | **Grasp** industry processes on software development to become IT industry-savvy. | 2 | Understanding |
| **CO2** | **Prepare** with the spirit of team-working and importance of using artifacts at SDLC phases. | 3 | Applying |
| **CO3** | **Distinguish** and evaluate procedural & OO based development practices. | 4 | Analyzing |
| **CO4** | **Integrate** expertise on CASE tools usage especially for design and testing of software to undertake industrial strength software projects. | 6 | Creating |

**CO-PO Mapping :**

| PO and PSO | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | - | - | 3 | - | - | - | - | - | - | - | 3 | 2 | 3 | - |
| **CO2** | - | - | 1 | 2 | - | - | - | 3 | 3 | 3 | - | - | - | - |
| **CO3** | - | - | - | - | 2 | - | - | - | - | - | - | - | - | - |
| **CO4** | - | - | 2 | - | - | - | - | - | - | - | - | 2 | | 3 |

*1: Low, 2: Medium, 3: High*

**Assessments :**

**Teacher Assessment:**

Two components of In Semester Evaluation (ISE), One Mid Semester Examination (MSE) and one End Semester Examination (ESE) having 20%, 30% and 50% weights respectively.

| Assessment | Marks |
|---|---|
| ISE 1 | 10 |
| MSE | 30 |
| ISE 2 | 10 |
| ESE | 50 |

ISE 1 and ISE 2 are based on pedagogy such as brainstorming, role play, quiz, presentations etc.
MSE: Assessment is based on 50% of course content (Normally first three modules)
ESE: Assessment is based on 100% course content with 70-80% weightage for course content (normally last three modules) covered after MSE.

**Course Contents:**

| | |
|---|---|
| **Module 1: Software Processes** | **6 Hrs.** |
| Need of software engineering approach, ETVX model, project management process, software development process & models, configuration management process, process management process. | |
| **Module 2: Software Quality & Project Planning** | **6 Hrs.** |
| Quality objectives, software quality factors, PAF Model, quality standards, project management plan, cost estimation, project scheduling, personnel planning with WBS, risk management. | |
| **Module 3: Software Requirement Analysis & Function Oriented Design** | **7 Hrs.** |
| Software requirement process, need and characteristics of SRS artifact, design principles, module level concepts, design notation and specifications, structured | |

| | |
|---|---|
| design methodology. | |
| **Module 4: Object Oriented Design with UML & Continual Integration** | **8 Hrs.** |
| UML model, UML diagrams: Use-case, Class, Activity, State-chart, Interaction, Sequence, Collaboration, Component, Deployment. Continual integration with Agile model process frameworks. | |
| **Module 5: User Interface Design & Coding** | **4 Hrs.** |
| UI rules, UI analysis and steps in UI design, best programming practices such as TDD & pair programming, verification. | |
| **Module 6: Software Testing** | **8 Hrs.** |
| Testing purpose and concepts, test process, levels of testing, regression testing, test case design for functional testing & structural testing. Study of Open-source Tools. | |

**Module wise Measurable Students Learning Outcomes :**

**The student should be able to:**

**Module 1: Software Processes**

- Awareness of Software processes & Models used at IT.

**Module 2: Software Quality & Project Planning**

- Grasp quality parameters and standards such as PAF.
- Know & prepare project planning phases and responsibilities with WBS.

**Module 3: Software Requirement Analysis & Function Oriented Design**

- As per SDLC phase understand requirement process and need of SRS artifact. Understand functional & non-functional requirements as well. Realize the importance of design aspects, concepts & methodology. Practices to learn how to draw DFD on requirements.

**Module 4:Object Oriented Design with UML & Continual Integration**

- Building capability to draw & distinguish various UML diagrams on requirements. Articulating usage of Continual integration with Agile model process frameworks.

**Module 5: User Interface Design & Coding**

- Know the UI aspect of interactive design for enterprise applications.
- Learn best coding standards/practices such as TDD, pair programming and how to verify code.

**Module 6: Software Testing**

- Integrate expertise on how testing helps in quality of software. Know testing concepts, levels of testing. Learn and practice Black & white box testing along with test case generations using open-source tools.

# ODD Semester

# Professional Core (Lab) Courses

| Title of the Course: Programming Lab 1<br>Course Code: 5CS251 | L | T | P | Cr |
|---|---|---|---|---|
| | 0 | 0 | 2 | 1 |

**Desirable Requirements:** Introduction to any Programming Language

**Textbooks:**

1. Herbert Schildt, "The Complete Reference: C++" Tata McGraw-Hill, 4th Edition, 2010
2. E Balaguruswamy, "Object Oriented Programming with C++", Tata McGraw-Hill, 4th Edition, 2008
3. Kenneth Lambert, "Fundamentals of Python: First Programs" Course Technology, Cengage Learning.2nd edition, 2017

**References:**

1. Stanley B. Lippman , "C++ Primer" Pearson , 4th Edition, Jan 2010

**Course Objectives :**

The course covers fundamentals of object oriented concepts using C++ & Python programming with syntax and examples. Course objectives of this course are as follows:

1. To provide in-depth coverage of object-oriented programming principles and techniques using C++ and Python.
2. To inculcate the advanced programming concepts in C++ and Python.

**Course Learning Outcomes:**

| CO | After the completion of the course the student should be able to | Bloom's Cognitive | |
|---|---|---|---|
| | | level | Descriptor |
| CO1 | **Explain** the features of object oriented programming using C++ and Python. | 2 | Understanding |
| CO2 | **Demonstrate** the solution to real world problems using C++ and Python | 3 | Applying |

**CO-PO Mapping :**

| PO and PSO | PO1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | - | - | - | - | - | - | - | - | - | - | - | - | 1 | - |
| CO2 | - | - | - | - | 2 | - | - | - | - | - | - | - | 2 | - |

*1:Low, 2:Medium, 3:High*

**Assessments:**

**Lab Assessment:**

There are four components of lab assessment, LA1, LA2, LA3 and Lab ESE.

IMP: Lab ESE is a separate head of passing.

| Assessment | Based on | Conducted by | Conduction and Marks Submission | Marks |
|---|---|---|---|---|
| LA1 | Lab activities, attendance, journal | Lab Course Faculty | During Week 1 to Week 4<br>Submission at the end of Week 5 | 25 |
| LA2 | Lab activities, attendance, journal | Lab Course Faculty | During Week 5 to Week 8<br>Submission at the end of Week 9 | 25 |
| LA3 | Lab activities, attendance, journal | Lab Course Faculty | During Week 10 to Week 14<br>Submission at the end of Week 14 | 25 |
| Lab ESE | Lab Performance and related documentation | Lab Course faculty | During Week 15 to Week 18<br>Submission at the end of Week 18 | 25 |

Week 1 indicates starting week of Semester.

Lab activities/Lab performance shall include performing experiments, mini-project, presentations, drawings, programming and other suitable activities, as per the nature and requirement of the lab course.
The experimental lab shall have typically 8-10 experiments.

**Course Contents:**

| **Module 1: Introduction to object oriented programming** | **5 Hrs.** |
|---|---|
| Introduction to properties of object oriented programming, Beginning with c++ programs, operators, control structures, loops, examples with class and objects, Functions in c++, function overloading, Constructors, Destructors, operator overloading, static class members.<br>**Experiments:**<br>1. Program based on creating Class and Object.<br>2. Program based on constructor and destructor. | |
| **Module 2: Properties of object oriented programming** | **6 Hrs.** |
| Inheritance and its types, pointers, virtual functions, Polymorphism. File Handling, Exception Handling, Templates, and Namespace fundamentals. Overview of Stream classes<br>**Experiments:**<br>1. Implementation of Inheritance and polymorphism.<br>2. Working with files.<br>3. Use of template, generic template and function.<br>4. Creation of namespaces. | |
| **Module 3: Introduction and getting started with python programming** | **4 Hrs.** |
| Running Code in the Interactive Shell, Input, Processing, and Output, Editing, Saving, and Running a Script, Behind the Scenes: How Python Works.<br>Data Types and expressions: Numeric Data Types and Character Sets, Integer, Floating-Point Numbers, Character Sets, Arithmetic Expressions, Functions and Modules.<br>**Experiments:**<br>1. Introduction and getting started with python programming: running code in the interactive shell<br>2. Program based on expression, data type, functions | |
| **Module 4: Features of python programming** | **4 Hrs.** |
| Loops and selection statements, String, Lists and dictionaries: List Literals and Basic Operators, List Methods for Inserting and Removing Elements, Dictionary Literals.<br>**Experiments:**<br>Programs based on implementation of loops, strings, lists and dictionaries. | |
| **Module 5: Design with Classes** | **4 Hrs.** |
| Getting Inside Objects and Classes, A First Example: The Student Class, Graphical User Interfaces, Coding Simple GUI-Based Programs, Windows GUI components.<br>**Experiments:**<br>Programs based on Graphical user interface design using python. | |
| **Module 6: Multi-Threading, Exception handling and File handling using python** | **3 Hrs.** |
| Multi-threading, Exception handling, file handling.<br>**Experiments:**<br>1. Programs related to Multi-threading, Exception handling, file handling. | |

| **Title of the Course: Data Structures Lab**<br>**Course Code: 5CS253** | L | T | P | Cr |
|---|---|---|---|---|
| | 0 | 0 | 2 | 1 |

**Desirable requirements:** Programming in C including pointers and File Handling

**Textbooks:**

1. Richard F. Gilberg, Behrouz A. Forouzan, "Data Structures, A Pseudocode Approach With C", Cengage Learning, Second Edition, 2014
2. S. Lipschutz, "Data Structures", Schaum's Outlines Series, Tata McGraw-Hill, 2013
3. Ellis Horowitz, S. Sahni, D. Mehta, "Fundamentals of Data Structures in C++", Galgotia Book Source, New Delhi, 2008

**References:**

1. Yashavant Kanetkar, "Understanding pointers in C", BPB Publication, 2009
2. N. B. Venkateshwarlu, E. V. Prasad, "C and Data Structures", S. Chand and Company, 2010

**Course Objectives:** This laboratory course focuses on practicing various linear and nonlinear data structures introduced in the Data Structure theory course. The assignment list mainly emphases on explaining characteristics of various data structures and their applications.

1. To develop and improve skills in programming in a systematic way and preparing the students for advanced computer science courses.
2. To make the students understand the concept of ADT, recursion, various searching and sorting algorithms along with their performance comparisons and to use appropriate data structure for modelling given problem.
3. To inculcate theoretical and practical knowledge of various linear and nonlinear data structures to solve real world problems.

**Course Learning Outcomes:**

| **CO** | **After the completion of the course the student should be able to** | Bloom's Cognitive | |
|---|---|---|---|
| | | level | Descriptor |
| **CO1** | **Demonstrate** the concept of recursion, abstract properties of various linear and nonlinear data structures, searching and sorting methods through implementation. | 3 | Applying |
| **CO2** | **Identify** suitable data structure to be used to solve the various problems. | 4 | Analyzing |
| **CO3** | **Select** appropriate searching, sorting method on the basis of its performance while developing application. | 5 | Evaluating |

**CO-PO Mapping :**

| **PO and PSO** | **PO 1** | **PO 2** | **PO 3** | **PO 4** | **PO 5** | **PO 6** | **PO 7** | **PO 8** | **PO 9** | **PO 10** | **PO 11** | **PO 12** | **PSO1** | **PSO2** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | **-** | **-** | **-** | **-** | **2** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | | **-** |
| **CO2** | **-** | **-** | **-** | **3** | **2** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **3** | **-** |
| **CO3** | **-** | **-** | **-** | **3** | **2** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **3** | **-** |

*1: Low, 2: Medium, 3: High*

**Assessments :**

**Lab Assessment:**

There are four components of lab assessment, LA1, LA2, LA3 and Lab ESE.
IMP: Lab ESE is a separate head of passing.

| Assessment | Based on | Conducted by | Conduction and Marks Submission | Marks |
|---|---|---|---|---|
| LA1 | Lab activities, attendance, journal | Lab Course Faculty | During Week 1 to Week 4<br>Submission at the end of Week 5 | 25 |
| LA2 | Lab activities, attendance, journal | Lab Course Faculty | During Week 5 to Week 8<br>Submission at the end of Week 9 | 25 |
| LA3 | Lab activities, attendance, journal | Lab Course Faculty | During Week 10 to Week 14<br>Submission at the end of Week 14 | 25 |
| Lab ESE | Lab Performance and related documentation | Lab Course faculty | During Week 15 to Week 18<br>Submission at the end of Week 18 | 25 |

Week 1 indicates starting week of Semester.
Lab activities/Lab performance shall include performing experiments, mini-project, presentations, drawings, programming and other suitable activities, as per the nature and requirement of the lab course.
The experimental lab shall have typically 8-10 experiments.

**Course Contents:**

**List of Experiments:**
Assignments based on topics covered in course 5CS203
1. Program based on structures and pointers in C
2. Program based on arrays and pointers in C
3. File handling and command line arguments
4. Implementation of recursion
5. Developing ADT for singly linked list and its applications
6. Developing ADT for Doubly linked list and its applications
7. Developing ADT for circular linked list and its applications
8. Developing ADT for stack and queue and their applications
9. Implementation of double ended queue
10. Implementation of recursive and non-recursive tree traversals
11. Binary search tree and application
12. Implementation of graph, DFS, BFS
13. Implementation of searching : linear search, binary search, Fibonacci search
14. Sorting Methods: Insertion sort, shell sort, heap sort, quick sort, merge sort, radix sort etc.
15. Implementation of hashing

| **Title of the Course: Computer Organization And Architecture Lab**<br>**Course Code**: **5CS255** | L | T | P | Cr |
|---|---|---|---|---|
| | 0 | 0 | 2 | 1 |

**Desirable requirements:** Programming by using assembly language

**Textbooks:**

1. William Stallings, “Computer Organization and Architecture: Designing for Performance”, Pearson Education, 8th Edition/10th Edition, 2010/2016
2. Ramesh S. Gaonkar, “Microprocessor architecture, programming & applications”, Penram International publications (India) Pvt. Ltd, 6th edition, 2013
3. N. Senthil Kumar, M. Saravanan, S. Jeevanathan, S. K. Shah, “Microprocessors and Interfacing”, Oxford Higher Education, 1st Edition, 2012

**References:**

1. David A. Patterson and John L. Hennessy “Computer Organization and Design: The Hardware/Software Interface”, Elsevier, 5th Edition, 2013
2. Ram, “Fundamentals of Microprocessors and Microcontrollers”, Dhanpat Rai Publications, 2012
3. ARM Based Development course, NPTEL(https://nptel.ac.in/courses/117106111/)

**Course Objectives:**

The main objective of this course is to demonstrate insights regarding working of different organizations, components and architectures of computer. The objectives are further divided as:

1. To infuse skills of drawing flowchart by using assembly language programming.
2. To demonstrate block transfer, arithmetical, logical operations and code conversion method by using assembly language programs.
3. To demonstrate the working of ARM processor.

**Course Learning Outcomes:**

| **CO** | **After the completion of the course the student should be able to** | Bloom’s Cognitive | |
|---|---|---|---|
| | | level | Descriptor |
| **CO1** | **Grasp** the fundamentals of assembly level programming using microprocessor trainer kit and interfacing with other I/O devices. | 2 | Understanding |
| **CO2** | **Demonstrate** programming proficiency using the various addressing modes and instructions set (Block transfer, arithmetical, logical operations and code conversion method) of 8085 and X-86 microprocessor. | 3 | Applying |

**CO-PO Mapping :**

| **PO and PSO** | **PO 1** | **PO 2** | **PO 3** | **PO 4** | **PO 5** | **PO 6** | **PO 7** | **PO 8** | **PO 9** | **PO 10** | **PO 11** | **PO 12** | **PSO1** | **PSO2** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | **2** | **-** | **-** | **-** | **3** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** |
| **CO2** | **-** | **-** | **3** | **2** | **2** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** |

*1: Low, 2: Medium, 3: High*

**Assessments :**

**Lab Assessment:**

There are four components of lab assessment, LA1, LA2, LA3 and Lab ESE.

IMP: Lab ESE is a separate head of passing.

| Assessment | Based on | Conducted by | Conduction and Marks Submission | Marks |
|---|---|---|---|---|
| LA1 | Lab activities, attendance, journal | Lab Course Faculty | During Week 1 to Week 4<br>Submission at the end of Week 5 | 25 |
| LA2 | Lab activities, attendance, journal | Lab Course Faculty | During Week 5 to Week 8<br>Submission at the end of Week 9 | 25 |
| LA3 | Lab activities, attendance, journal | Lab Course Faculty | During Week 10 to Week 14<br>Submission at the end of Week 14 | 25 |
| Lab ESE | Lab Performance and related documentation | Lab Course faculty | During Week 15 to Week 18<br>Submission at the end of Week 18 | 25 |

Week 1 indicates starting week of Semester.
Lab activities/Lab performance shall include performing experiments, mini-project, presentations, drawings, programming and other suitable activities, as per the nature and requirement of the lab course. The experimental lab shall have typically 8-10 experiments.

**Course Contents:**
Assignments based on topics covered in course 4CS252
Write assembly language programs

1. Introduction to digital fundamental circuit design.
2. Study of the design combinational and sequential circuit.
3. Introduction of Microprocessors and Study of 8085 Microprocessor and instruction set.
4. Write a program to perform 8-bit block transfer.
5. Write a program to perform 8-bit and 16-bit addition /subtraction/multiplication/division.
6. Write a program to find largest /smallest number in an array of data.
7. Write a program to find smallest no in an array of data.
8. Write a program to find 16 bit 2's complement no of 4340H
9. Write a program to transfer 16 bytes of data stored in location at C250 to C25F to new memory locations starting from C300 on words.
10. Write a program to transfer a block of data. The data is stored in memory from C550 H to C555F H. The data is to be stored from C570 H to C57F H in reverse order.
11. Write a program to arrange 10 bytes data in ascending /descending order. The data is stored in memory as an array starting from C100 H onwards.
12. Write Convert a binary number to a BCD number.
13. Write a program to square of number using lookup table.
14. Write X86/64 ALP to perform basic arithmetic operation.
15. Write X86/64 ALP to count number of positive and negative numbers from the array.
16. 16. Write X86/64 ALP to perform multiplication of two 8-bit hexadecimal numbers. Use successive addition and add and shift method (Use of 64-bit registers is expected).
17. Write X86/64 ALP to convert 4-digit Hex number into its equivalent BCD number and 5-digit BCD number into its equivalent HEX number.
18. Case study: ARM Processor.

# ODD Semester

# Minor Specialization Courses

| **Title of the Course: Data Structures**<br>**Course code: 1CSM01** | L | T | P | Cr |
|---|---|---|---|---|
| | 3 | 0 | 0 | 3 |

**Pre-Requisite Courses:** Programming in C including pointers and File Handling

**Textbooks:**

1. Richard F. Gilberg, Behrouz A. Forouzan, "Data Structures, A Pseudocode Approach With C",Cengage Learning, Second Edition, 2014
2. S. Lipschutz, "Data Structures,Schaum's" Outlines Series, Tata McGraw-Hill, 2013
3. Ellis Horowitz, S. Sahni, D. Mehta, "Fundamentals of Data Structures in C++", Galgotia Book Source, New Delhi, 2008

**References:**

1. Yashavant Kanetkar, "Understanding pointers in C", BPB Publication, 4th Edition, 2009
2. Jean-Paul Tremblay, Paul. G. Soresan, "An introduction to data structures with Applications", Tata Mc-Graw Hill International Editions, 2nd edition 1984
3. N. B. Venkateshwarlu, E. V. Prasad, "C and Data Structures", S. Chand and Company, 2010

**Course Objectives :**

1. To impart basic concepts of Data Structure and analyse efficiency of algorithm
2. To make the students understand elementary linear and non-linear data structures and make the students capable of applying appropriate data structure for modelling a given problem.
3. To provide a foundation to analyse and apply various searching and sorting techniques.

**Course Learning Outcomes:**

| **CO** | **After the completion of the course the student should be able to** | Bloom's Cognitive | |
|---|---|---|---|
| | | level | Descriptor |
| **CO1** | Explain the fundamental concepts of various linear and non-linear data structures with ADTs and write recursive algorithms. | 2 | Understanding |
| **CO2** | Identify suitable data structures to be used and apply it to solve the various problems. | 3 | Applying |
| **CO3** | Compare and analyse various searching and sorting methods based on inherent properties of data structures and the complexity of algorithms. | 4 | Analyzing |

**CO-PO Mapping :**

| **PO** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **12** | **PSO1** | **PSO2** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | **3** | | | | | | | | | | | | | |
| **CO2** | **3** | **3** | | **2** | | | | | | | | | **3** | |
| **CO3** | **3** | **3** | | **2** | | | | | | | | | **3** | |

*1: Low, 2: Medium, 3: High*

**Assessments :**

**Teacher Assessment:**

Two components of In Semester Evaluation (ISE), One Mid Semester Examination (MSE) and one End Semester Examination (ESE) having 20%, 30% and 50% weights respectively.

| Assessment | Marks |
|---|---|
| ISE 1 | 10 |
| MSE | 30 |
| ISE 2 | 10 |
| ESE | 50 |

ISE 1 and ISE 2 are based on assignment/declared test/quiz/seminar etc.

MSE: Assessment is based on 50% of course content (Normally first three modules)

| |
|---|
| ESE: Assessment is based on 100% course content with 70-80% weightage for course content (normally last three modules) covered after MSE. |

**Course Contents:**

| | |
|---|---|
| **Module 1 Introduction**<br>**Basic Concepts:** Algorithm, Pseudocode, ADT, Data Structure, Algorithmic Efficiency<br>**Recursion:** Direct and Indirect recursion, Recursive solution of Towers of Hanoi. | **Hrs. 5** |
| | |
| **Module 2 Linked Lists**<br>Concept of linked organization, Singly linked list, doubly linked list and dynamic storage management, circular linked list, Operations such as traversal, Searching, insertion and deletion, Representation of polynomials using linked lists | **Hrs. 7** |
| | |
| **Module 3 Stacks and Queues**<br>Fundamentals stack and queue as ADT, Representation and Implementation of stack and queue using sequential and linked organization, Insert and Delete operations, Circular queue: representation and implementation, Priority queue | **Hrs. 8** |
| | |
| **Module 4 Trees**<br>Basic terminology, binary trees and its representation, binary tree traversals, AVL Tree, Binary Search Trees, Heaps and its operations | **Hrs. 7** |
| | |
| **Module 5 Graphs**<br>Terminology and Representation of graphs using adjacency matrix, adjacency list and adjacency matrix, Traversals Depth First and Breadth First, Minimum Spanning Tree | **Hrs. 5** |
| | |
| **Module 6 Searching & Sorting Technique**<br>**Search:** Importance of searching, Sequential, Binary, Fibonacci search<br>**Sorting:** Importance of sorting, Insertion, Heap, Quick sort, Merge sort<br>**Hashing: Introduction** Hash functions. | **Hrs. 7** |

**Module wise Measurable Students Learning Outcomes :**

**After the completion of the course the student should be able to:**

**Module 1:**
- Explain the fundamental concepts and write recursive algorithms.

**Module 2:**
- Demonstrate concept of linked list and use of ADTs to solve the problem

**Module 3:**
- Discuss theoretically and use data structures like stacks and queues as the programmers' tool to develop the solution.

**Module 4:**
- Explain non-linear data structure tree and its basic operations.

**Module 5:**
- Discuss and implement graphs using various representations.

**Module 6:**
- Explain and compare various searching and sorting techniques.

# EVEN Semester

# EVEN Semester

# Professional Core (Theory) Courses

| **Title of the Course: Applied Mathematics for Computer Science and Engineering** | L | T | P | Cr |
|---|---|---|---|---|
| **Course Code: 5CS221** | 3 | 0 | 0 | 3 |

**Desirable requirements:** Engineering Mathematics I and Engineering Mathematics II

**Textbooks:**

**Textbooks:**

1. Gilbert Strang, "Linear Algebra and its applications", Cengage Learning, 4th edition, 2014
2. George J. Klir and Bo Yuan, " Fuzzy Sets and Fuzzy Logic : Theory and Applications", Pearson Education Services Pvt. Ltd., 4th edition, 2017
3. Timothy C. Urdan, " Statistics in Plain English", Routledge-Taylor and Fransis Group, 3rd Edition, Volume 1, 2010.
4. Alice Zheng, "Evaluating Machine Learning Models" O'Reilly Media, 2015

**References:**

2. Seymour Lipschutz and Mark Lipson,"Schaum's outlines of Theory and Problems of Linear Algebra", Tata McGraw Hill, 3rd Edition, 2007.
3. William Stein, "Elementary Number Theory: Primes, Congruences, and Secrets", Springer, 1st Edition, 2008.

**Course Objectives:** The main objective of this course is to build a foundation for solving problems in different domains such as Machine Learning, Artificial Intelligence, Scientific Computing, Cryptography etc. The objectives are further divided as:

2. To infuse an understanding of the mathematical theory of Linear Algebra, Evaluation metrics for computer science engineers.
3. To provide a foundation to solve practical problems in cryptography, data science and machine learning.
4. To give insights about the properties, operations and relations on Fuzzy sets.

**Course Learning Outcomes:**

| **CO** | **After the completion of the course the student should be able to** | Bloom's Cognitive | |
|---|---|---|---|
| | | level | Descriptor |
| **CO1** | **Illustrate** the concept of Linear Algebra and Fuzzy sets with case studies. | 2 | Understanding |
| **CO2** | **Apply** various evaluation metrics for result analysis | 3 | Applying |
| **CO3** | **Solve** mathematical problems using tools from mathematical areas, including algebra, analysis, evaluation metrics and number theory. | 3 | Applying |

**CO-PO Mapping :**

| **PO and PSO** | **PO 1** | **PO 2** | **PO 3** | **PO 4** | **PO 5** | **PO 6** | **PO 7** | **PO 8** | **PO 9** | **PO 10** | **PO 11** | **PO 12** | **PSO1** | **PSO2** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | **2** | - | - | - | - | - | - | - | - | - | - | - | - | - |
| **CO2** | - | **3** | - | - | - | - | - | - | - | - | - | - | **2** | - |
| **CO3** | **2** | - | **3** | - | - | - | - | - | - | - | - | - | **3** | - |

*1: Low, 2: Medium, 3: High*

**Assessments :**

**Teacher Assessment:**

Two components of In Semester Evaluation (ISE), One Mid Semester Examination (MSE) and one End Semester Examination (ESE) having 20%, 30% and 50% weights respectively.

| Assessment | Marks |
|---|---|
| ISE 1 | 10 |

| | |
|---|---|
| MSE | 30 |
| ISE 2 | 10 |
| ESE | 50 |

ISE 1 and ISE 2 are based on assignment/declared test/quiz/seminar/oral etc.
MSE: Assessment is based on 50% of course content (Normally first three modules)
ESE: Assessment is based on 100% course content with 70-80% weightage for course content (normally last three modules) covered after MSE.

**Course Contents:**

| | |
|---|---|
| **Module 1 Vector Spaces** | **6 Hrs.** |
| Introduction, Vector spaces, Linear combinations, Spanning sets, Subspace, Linear dependence and independence, Basis and dimension, Null space, Column space, Row space, Rank-Nullity theorem. | |
| **Module 2 Advanced Concepts in Linear Algebra** | **7 Hrs.** |
| Vector dot product, Inner product space, Length and orthogonality, Orthogonal sets, Orthonormal sets, Orthogonal projections, Gram-Schmidt Process, Least square problems, Applications and significance of Eigen values and Eigen vectors. | |
| **Module 3 Fuzzy Sets** | **7 Hrs.** |
| Introduction to characteristics functions, First decomposition theorem, Fuzzy relations, examples, Fuzzy equations, Operations on Fuzzy sets. | |
| **Module 4 Exploratory Data Analysis** | **6 Hrs.** |
| Discrete and continuous random variables, PDF, CDF, percentile, Inter quartile range, central tendency (mean, mod, median, dispersion, skewness, kurtosis), variance, standard deviation, Mean Absolute Deviation (MAD), Standardization (Z-score), Normalization. | |
| **Module 5 Evaluation metrics** | **6 Hrs.** |
| Intersection over union (IoU), Inception score, Frechet Inception distance, BLEU, METEROR, Rough, CIDER score, Confusion Matrix, F1 Score, Recall or Sensitivity, Gain and Lift Charts, Kolmogorov Smirnov Chart, AUC – ROC, Log Loss, Gini Coefficient, Concordant – Discordant Ratio, Root Mean Squared Error. | |
| **Module 6 Number theory** | **7 Hrs.** |
| Primality Testing: Primality Tests, Pseudo primes, Fermat’s pseudo primes, Factorization techniques, Multiplicative inverse. Euclidean algorithm, Chinese remainder theorem, Fermat’s little theorem, Wilson’s theorem, Primitive roots, Quadratic residues. | |

**Module wise Measurable Students Learning Outcomes :**
**After the completion of the course the student should be able to:**

**Module 1:**
- Solve the problems on vector spaces.

**Module 2:**
- Apply the core concept of Linear Algebra to real life applications.

**Module 3:**
- Illustrate the knowledge of fuzzy set and system through set theory**.**

**Module 4:**
- Visualize and understand the different data from science and engineering domains using statistics tools.

**Module 5:**
- Make use of appropriate evaluation mentics in the analysis of simple datasets or proposed method.

**Module 6:**
- Identify how number theory is related to and used in cryptography.

| Title of the Course: Formal Language and Automata Theory<br>Course code: 5CS222 | L | T | P | Cr |
|---|---|---|---|---|
| | 3 | 1 | 0 | 4 |

**Desirable requirements:** Discrete Mathematics

**Textbooks:**

1. John C. Martin, "Introduction to Languages & Theory of Computation", Tata McGraw-Hill , 3rd Ed., 2009
2. John E.Hopcraft, Rajeev Motwani, Jeffrey D. Ullman, "Introduction to Automata Theory, Languages and Computations", Pearson Edu., 3rd Ed., 2009
3. Daniel I. A. Cohen, "Introduction to Computer Theory", Wiley, 2nd Ed., 2008

**References:**

1. J.P.Tremblay & R.Manohar, "Discrete Mathematical Structures with Applications to Computer Science", Tata McGraw-Hill, 2008
2. K.L.P. Mishra & N. Chandrasekaran, "Theory of Computer Science", PHI, 2nd Ed., 2002
3. Vivek Kulkarni, "Theory of Computation", Oxford University Press, 1st Ed., 2013

**Course Objectives :**

This course is one of the core subjects for Computer Science and Engineering students which deals with the theory related to the practical aspects of computation. The main emphasis is on solving problems universally encountered in designing a language translator, regardless of source or target machine.

1. To explain basic terminologies related to formal languages and Automata theory.
2. To provide foundation to critically analyze grammars, regular expressions, languages, and their relationship.
3. To inculcate theoretical knowledge to design Automata/Machine as a language descriptor and recognizer.

**Course Learning Outcomes:**

| CO | After the completion of the course the student should be able to | Bloom's Cognitive | |
|---|---|---|---|
| | | level | Descriptor |
| CO1 | **Explain** the fundamental concepts related to string, language, grammar and their properties | 2 | Understanding |
| CO2 | **Examine** and **Construct** different grammars, regular expressions and relate the languages defined by different grammars and regular expressions. | 3 | Applying |
| CO3 | **Design** Finite Automata, PDA, Turing Machine to recognize different languages. | 6 | Creating |

**CO-PO Mapping :**

| PO and PSO | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CO2 | 3 | 3 | - | 2 | - | - | - | - | - | - | - | - | 3 | - |
| CO3 | 3 | 3 | - | 2 | - | - | - | - | - | - | - | - | 3 | - |

*1: Low, 2: Medium, 3: High*

**Assessments :**

**Teacher Assessment:**

Two components of In Semester Evaluation (ISE), One Mid Semester Examination (MSE) and one End Semester Examination (ESE) having 20%, 30% and 50% weights respectively.

| Assessment | Marks |
|---|---|
| ISE 1 | 10 |
| MSE | 30 |
| ISE 2 | 10 |
| ESE | 50 |

ISE 1 and ISE 2 are based on assignment/declared test/quiz/seminar
MSE: Assessment is based on 50% of course content (Normally first three modules)
ESE: Assessment is based on 100% course content with 70-80% weightage for course content (normally last three modules) covered after MSE.

**Course Contents:**

| | |
|---|---|
| **Module 1** | **6 Hrs.** |
| Types of Proofs, Mathematical Induction and Recursive definitions, Regular expressions & corresponding regular languages, examples and its applications, unions, intersection & complements of RL, Pumping Lemma for RL. | |
| **Module 2** | **10 Hrs.** |
| Deterministic finite automata definition and representation, Nondeterministic F.A., NFA with ^ transitions, Equivalence of DFAs, NFAs and NFA-^s. Kleene's theorem & proofs, minimum state FA for a regular language, minimizing number of states in an FA. | |
| **Module 3** | **6 Hrs.** |
| Definition and types of grammars and languages, derivation trees and ambiguity, CFL's & Non CFL's., Union, Concatenation and Kleene's operations, Intersection and complements of CFLs, Pumping Lemma & examples. | |
| **Module 4** | **6 Hrs.** |
| Definition, deterministic PDA, types of acceptance and conversions to each other, CFGs & PDAs, Top-Down, & Bottom-up parsing. | |
| **Module 5** | **4 Hrs.** |
| BNF, CNF and GNF notations, Eliminating ^ production and unit productions from a CFG, Eliminating useless variables from a Context Free Grammar. | |
| **Module 6** | **7 Hrs.** |
| Models of computation, definition of TM as Language Acceptors, Combining Turing Machines, computing a function with a TM. Variations in TM, TMs with doubly-infinite tapes, more than one tape, Nondeterministic TM and Universal TM. | |

**Module wise Measurable Students Learning Outcomes :**
**After the completion of the course the student should be able to:**

**Module 1:**
- Explain basic terminologies related to theory of computation and construct regular expressions recognising regular languages.

**Module 2:**
- Explain finite state system and design finite automata for regular languages.

**Module 3:**
- Explain language syntax, grammar construct context free grammars for languages.

**Module 4:**
- Design push down automata and demonstrate different parsing techniques.

**Module 5:**
- Explain different normal forms and their applications.

**Module 6:**
- Design Turing machines for different formal languages and illustrate variants of Turing machine.

**Tutorial:**
Based on the syllabus, 15 assignments will be given to the students focusing on problem solving approach.

| **Title of the Course: Operating Systems**<br>**Course Code: 5CS223** | L | T | P | Cr |
|---|---|---|---|---|
| | 3 | 0 | 0 | 3 |

**Desirable requirements:**

**Textbooks:**

1. Abraham Silberschatz, Peter Baer Galvin, Greg Gagne, "Operating System Concepts", John Wiley, 10th Edition, 2018
2. D. M. Dhamdhere,"Operating Systems A Concept-Based Approach", McGraw-Hill, 3rd edition, 2012

**References:**

1. Charles Crowley, "Operating System A Design Oriented Approach", McGraw-Hill Education Pvt. Ltd., 2001
2. Achyut S. Godbole, Atul Kahate "Operating System with Case Studies in Unix, Netware and Windows NT", Tata McGraw Hill,3rd edition, 2010
3. D.M.Dhamdhere, "System Programming and Operating Systems", Tata McGraw - Hill, 2nd Edition, 1999

**Course Objectives:** A successful student will be able to understand the basic components of a computer operating system, and the interactions among the various components. The course will cover an introduction on the policies for scheduling, deadlocks, memory management, synchronization, system calls, and file systems.

1. To introduce students with basic concepts of operating system, system software, threads and their communication
2. To familiarize the students with various views and management policies adopted by O.S. as pertaining with processes , Deadlock , memory , File and I/O operations.
3. To provide the knowledge of basic concepts towards process synchronization, Mutual exclusion algorithms and deadlock detection algorithms and related issues.
4. To inculcate importance of memory management, storage management and I/O device management in OS design.

**Course Learning Outcomes:**

| **CO** | **After the completion of the course the student should be able to** | Bloom's Cognitive | |
|---|---|---|---|
| | | level | Descriptor |
| **CO1** | **Describe** the primitive concepts of Operating System services and system software functionality. | 2 | understanding |
| **CO2** | **Illustrate** Process management, Memory management, Storage management and I/O management core techniques in effective execution of processes. | 3 | applying |
| **CO3** | **Assess** various algorithms of Process, Memory, Storage & I/O management for performance and quality criterion. | 5 | evaluating |

**CO-PO Mapping :**

| **PO and PSO** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO 11** | **PO12** | **PSO1** | **PSO2** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | **2** | - | - | - | - | - | - | - | - | - | - | - | - | - |
| **CO2** | **3** | **2** | - | - | - | - | - | - | - | - | - | - | **2** | - |
| **CO3** | **2** | **3** | - | - | - | - | - | - | - | - | - | - | **3** | - |

*1: Low, 2: Medium, 3: High*

**Assessments :**

**Teacher Assessment:**

Two components of In Semester Evaluation (ISE), One Mid Semester Examination (MSE) and one End Semester Examination (ESE) having 20%, 30% and 50% weights respectively.

| Assessment | Marks |
|---|---|

| | |
|---|---|
| ISE 1 | 10 |
| MSE | 30 |
| ISE 2 | 10 |
| ESE | 50 |

ISE 1 and ISE 2 are based on assignment/declared test/quiz/seminar etc.
MSE: Assessment is based on 50% of course content (Normally first three modules)
ESE: Assessment is based on 100% course content with 70-80% weightage for course content (normally last three modules) covered after MSE.

**Course Contents:**

| | |
|---|---|
| **Module 1 : Overview of Operating System** | **6Hrs.** |
| Notion of operating systems ,Operating system services, user operating system interface, system calls, types of windows and UNIX system calls, system programs, operating system design and implementation, operating system structure, Virtual Machines<br>**Case Study** : Windows and UNIX Operating System | |
| **Module 2 : System Softwares** | **6Hrs.** |
| Notions of editors, Macro processors, Compilers, Assemblers, loaders & linkers, Multiprogramming and time sharing. | |
| **Module 3 : Process Management** | **7Hrs.** |
| **Process Concept :**<br>Process concept, process scheduling, operation on process, inter-process communication, example of IPC systems and communication in client-server systems.<br>**Process Scheduling:**<br>Basic concepts, scheduling criteria, scheduling algorithm, algorithm evaluation. | |
| **Module 4 : Process Coordination** | **7Hrs.** |
| **Synchronization :**<br>Background, the critical section problem, Peterson's solution, synchronization hardware, semaphores, classic problems of Synchronization.<br>**Deadlock :**<br>System model, deadlock characterization, methods for handling deadlocks, deadlock prevention, deadlock avoidance, deadlock detection. | |
| **Module 5 : Memory Management** | **8Hrs.** |
| **Memory-Management Strategies :**<br>Background, swapping, contiguous memory allocation, paging, structure of the page table, Segmentation.<br>**Virtual Memory Management :**<br>Background, demand paging, copy-on-write, page replacement algorithms, allocation of frames, Thrashing. | |
| **Module 6 : Storage Management** | **5Hrs.** |
| **File System :**<br>File concept, access methods, directory and disk structure, file-system mounting, file sharing, protection. | |

**Module wise Measurable Students Learning Outcomes :**

**Module 1:**
- Describe the basic functions of OS, its components and its working.

**Module 2:**
- Illustrate the basic terminologies of system softwares like compiler, assembler.

**Module 3:**
- Describe the issues related to process management and solve the CPU scheduling problems.

**Module 4:**
- Describe different ways of process synchronization and handling deadlocks.

**Module 5:**
- Explain the issues related to memory management.

**Module 6:**
- Describe different ways of how logical view of File system is provided to the users by OS.

| Title of the Course: Database Engineering<br>Course Code: 5CS224 | L | T | P | Cr |
|---|---|---|---|---|
| | 3 | 0 | 0 | 3 |

**Desirable requirements:** Data Structures

**Textbooks:**

1. Abraham Silberschatz, Henry F. Korth and S. Sudarshan, “Database System Concepts”, Mc-Graw Hill New York Publications, 6th Edition, 2011

**References:**

1. Raghu Ramakrishnan and Johannes Gehrke, “Database Management Systems”, Mc-Graw Hill New York Publications, 3rd Edition, 2003
2. Ramez Elmasri and Shamkant Navathe, Benjamin Cummings, “Fundamentals of Database Systems”, 3rd Edition, 1999 / later
3. Bipin c. Desai "An Introduction to Database System", Galgotia Publications, 2nd revised edition

**Course Objectives :** Goal of this course is to elucidate basics of database design, provide bird view of data using ER- model, introduce relation model to depict relation between them, discussion of clause to manipulate, access data using Query language, apply normalization to remove redundancy, explain access control mechanism for security and introduce storage and indexing strategies. Course objectives are as follows,

1. To Impart various functional components of database design, manipulation and access language, redundancy issue, storage strategy, transaction and concurrency strategy and its security and recovery system
2. To Introduce an physical and logical database designs, database modeling, relational, hierarchical and network models
3. To Provide in depth understanding of relational model and the theoretical issues associated with relational database design.
4. To Exemplify various SQL clauses of Data manipulation, Data access and Data control.

**Course Learning Outcomes:**

| CO | After the completion of the course the student should be able to | Bloom’s Cognitive | |
|---|---|---|---|
| | | level | Descriptor |
| **CO1** | **Explain** concepts of conceptual database design, redundancy problem, storage system, transaction processing, concurrency control and security in DBMS | 2 | Understanding |
| **CO2** | **Apply** theoretical knowledge to design ER diagram, prepare relational schema using appropriate constraints and normalization for a given specification of the requirement | 3 | Applying |
| **CO3** | **Construct** SQL queries for Open source and Commercial DBMS for a given specification schema to fetch essential data | 3 | Applying |

**CO-PO Mapping :**

| **PO and PSO** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 2 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| **CO2** | 3 | 2 | 3 | - | - | - | - | - | - | - | - | - | 2 | - |
| **CO3** | - | - | 2 | - | - | - | - | - | - | - | - | - | - | - |

*1: Low, 2: Medium, 3: High*

**Assessments :**

**Teacher Assessment:**

Two components of In Semester Evaluation (ISE), One Mid Semester Examination (MSE) and one End Semester Examination (ESE) having 20%, 30% and 50% weights respectively.

| Assessment | Marks |
|---|---|
| ISE 1 | 10 |
| MSE | 30 |
| ISE 2 | 10 |
| ESE | 50 |

**ISE 1 and ISE 2** are based on assignment/declared test/quiz/seminar etc.
**MSE**: Assessment is based on 50% of course content (Normally first three modules)
**ESE**: Assessment is based on 100% course content with 70-80% weightage for course content (normally last three modules) covered after MSE.

**Course Contents:**

| | |
|---|---|
| **Module 1: Introduction and Database Modelling using ER Model** | **6 Hrs.** |
| **Introduction:** General introduction to database systems, its advantages and applications, Database System Architecture, Database users and Administrator, Data models, Database management system, Database languages, View of Database, Data Models.<br>**ER Model:** Entity set, Entity types, attributes, Notations, Relationship sets, Relationship types, Keys- super key, candidate key, primary key, Extended Features of ER Model-Generalization, Specialization and aggregation | |
| **Module 2: Relational Model and SQL** | **8 Hrs.** |
| **Relational Model**: Structure of Relational Database, Reduction of ER model into Relational schemas, Schema-instance distinction, Referential integrity and foreign keys, Relational algebra, Tuple relation calculus, Domain relational calculus, Example queries,<br>**SQL**: Introduction to SQL, Data definition statements with constraints, Insert, Update and Delete, Set Operations, Aggregate functions group by and having clauses, Nested Queries, Views, Complex Queries, Joins. | |
| **Module 3: Relational Database Design** | **7 Hrs.** |
| Importance of a good schema design, Motivation for normal forms, Atomic domains and 1NF, Dependency theory - functional dependencies, Closure of a set of FD's, Definitions of 2NF, 3NF and BCNF, Decomposition algorithms and desirable properties of them, Multi-valued dependencies and 4NF, Join dependencies and definition of 5NF, Temporal Functional Dependencies | |
| **Module 4: Data Storage and Indexing** | **6 Hrs.** |
| File organization, Organization of records in files, Data Dictionary, Database Buffer, and Indexing: Concept, Ordered Indices-Primary, Secondary, Multilevel, B+ Tree Index, Hashing, Hash Indices, Dynamic hashing, Multiple key access, Bitmap Indices. | |
| **Module 5: Transaction Processing and Concurrency Control** | **7 Hrs.** |
| **Transaction Processing**: Concept, ACID properties, Transaction states, Storage Structure, Implementation of atomicity, isolation and durability, Serializability, Testing for serializability.<br>**Concurrency Control**: Lock-based protocols, Timestamp - based Protocols, Validation - based Protocols, Multiple Granularities, Deadlock handling. | |
| **Module 6: Database security and Recovery System** | **5 Hrs.** |
| Authentication, Authorization and access control, Discretionary Access Control (DAC), Mandatory Access Control (MAC) and Role of the Database Administrator (RBAC) models, Intrusion detection, SQL injection. Failure classification, Recovery and Atomicity, Log based recovery, Checkpoints, Shadow Paging, Buffer management in crash recovery. | |

**Module wise Outcomes**

At end of each module students will be able to

**Module 1**

- Explain the concept of database system and its applications, database system architecture and various database models, appropriate constraints, describes entity, attribute, relation, key, primary key, super key, candidate key, extended features specialization and generalization with notations.

**Module 2**

- Construction of ER- model, relation model to represent complex data in pictorial form for better design and extract information from the database by constructing SQL queries.

**Module 3**

- Illustrate and use the concept of functional dependency and various normal forms for “good” database design.

**Module 4**

- Describe file organization concepts and various indexing techniques.

**Module 5**

- Describe the concept of transaction and implement transactions and compare various concurrency control mechanisms and apply the concepts for hands-on experimentation.

**Module 6**

- Identify and define Authentication, Authorization and access control mechanisms for data security and recovery mechanisms using log based recovery, checkpoints, shadow paging, and Buffer management in crash recovery.

| Title of the Course: Computer Network<br>Course Code: 5CS225 | L | T | P | Cr |
|---|---|---|---|---|
| | 3 | 0 | 0 | 3 |

**Desirable Requirements :** Data Communication

**Textbooks:**

1. Behrouz A. Forouzan, "Data communication and Networking", Tata McGraw-Hill, 4th/5th edition, 2017
2. William Stallings, "Data and Computer Communications", Prentice Hall (PHI) , 8th/9th edition, 2010/2011
3. Andrew S. Tanenbaum, "Computer Networks", Prentice Hall (PHI), 3rd /5th Edition, 2008/2010

**References:**

1. James F. Kurose and Keith W. Ross, "Computer Networking: A Top-Down Approach Featuring the Internet", Pearson Education,5th /6th edition, 2012/2013
2. Thomas G. Robertazzi , "Computer Networks and Systems: Queueing Theory and Performance Evaluation", Springer, 2nd edition, 2000

**Course Objectives:** The course is designed to give a clear view of computer networking by introducing them to networking protocols, features and techniques. Objectives are divided as below:

1. To recall protocol functions and issues related to Data Link layer.
2. To explain the features and operations of various protocols in TCP/IP suite.
3. To elaborate the design and configuration of various networking protocols.

**Course Learning Outcomes:**

| CO | After the completion of the course the student should be able to | Bloom's Cognitive | |
|---|---|---|---|
| | | level | Descriptor |
| **CO1** | **Articulate** networking basics and different layers in networking models | 2 | Understanding |
| **CO2** | **Examine** the features and operations of protocols of data Link Layer, Network layer, transport layer and Application Layer. | 3 | Applying |
| **CO3** | **Categorize** and **compare** networking protocols. | 4 | Analyzing |

**CO-PO Mapping :**

| PO and PSO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 1 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CO2 | 1 | 2 | - | - | - | - | - | - | - | - | - | - | 1 | - |
| CO3 | - | - | 1 | - | - | - | - | - | - | - | - | - | - | - |

*1: Low, 2: Medium, 3: High*

**Assessments :**

**Teacher Assessment:**

Two components of In Semester Evaluation (ISE), One Mid Semester Examination (MSE) and one End Semester Examination (ESE) having 20%, 30% and 50% weights respectively.

| Assessment | Marks |
|---|---|
| ISE 1 | 10 |
| MSE | 30 |
| ISE 2 | 10 |
| ESE | 50 |

ISE 1 and ISE 2 are based on assignment/declared test/quiz/seminar etc.
MSE: Assessment is based on 50% of course content (Normally first three modules)
ESE: Assessment is based on 100% course content with 70-80% weightage for course content (normally last three modules) covered after MSE.

**Course Contents:**

| | |
|---|---|
| **Module 1: Networking Basics** | **4 Hrs.** |
| Evolution of network, Introduction to Computer Networks, Types of Network, Physical & Logical Topology, Introduction to different types of network, internetworking, Intranet, Internet and revisit to Reference models-OSI, TCP/IP. | |
| **Module 2:Data Link Layer** | **8 Hrs.** |
| The Channel Allocation Problem-Static and Dynamic Allocation, Multiple Access Protocols-ALOHA, CSMA, CSMA/CD, WDMA, WLAN. Ethernet-cabling, coding, MAC Protocol, Binary exponential back off algorithm, performance, switched Ethernet, fast Ethernet, gigabit Ethernet. Wireless LANs-802.11 stack, physical layer, MAC, frame structure Bluetooth-architecture, application, protocol stack, Data Link Layer Switching- Bridge, hub, repeater, switch, router, gateways, VLAN. | |
| **Module 3: The Network Layer:** | **7 Hrs.** |
| Logical Addressing: IPv4 addresses , IPv6 addresses, internetworking, IPv4, IPv6, transition from IPv4 to IPv6, Address Mapping, ICMP, IGMP, Unicast and Multicast Routing, Numerical problems on logical addressing. | |
| **Module 4: The Transport Layer**: | **7 Hrs.** |
| Process-to-process delivery, user datagram protocol (UDP), TCP, SCTP, Socket Programming, | |
| **Module 5: Congestion Control and Quality of Service** | **6 Hrs.** |
| Congestion, congestion control, congestion control in TCP, introduction to queuing theory, quality of service, techniques to improve qos, integrated services, differentiated services. | |
| **Module 6: Application Layer** | **7 Hrs.** |
| Domain Name Space (DNS), DDNS, TELNET, EMAIL, File Transfer Protocol (FTP), WWW, HTTP, SNMP. | |

**Module wise Measurable Students Learning Outcomes :**
**After the completion of the course the student should be able to:**

**Module1 :**

- Articulate the networking Basics.

**Module2 :**

- Explain and examine wired and wireless communication with medium access control layer.

**Module3 :**

- Understand the working of network layer and compare the techniques for routing at network layer.

**Module4 :**

- Examine the services provided by transport layer.

**Module5 :**

- Compare techniques to improve QoS. and congestion control

**Module6 :**

- Articulate knowledge of various application layer protocols.

# EVEN Semester

# Professional Core (Lab) Courses

| Title of the Course: Database Engineering Lab<br>Course Code: 5CS274 | L | T | P | Cr |
|---|---|---|---|---|
| | 0 | 0 | 2 | 1 |

**Desirable requirements:** Data Structures

**Textbooks:**

1. Abraham Silberschatz, Henry F. Korth and S. Sudarshan, "Database System Concepts", Mc-Graw Hill New York Publications, 6th Edition, 2011

**References:**

1. Raghu Ramakrishnan and Johannes Gehrke, "Database Management Systems", Mc-Graw Hill New York Publications, 3rd Edition, 2003
2. Ramez Elmasri and Shamkant Navathe, Benjamin Cummings, "Fundamentals of Database Systems", 3rd Edition, 1999 / later
3. Bipin c. Desai "An Introduction to Database System", Galgotia Publications, 2nd revised edition

**Course Objectives :** Main objective of this course is to practically demonstrate the ER- model for given specific requirement using open source or commercialized tool, show transformation of ER-model into Relation model on paper as well as on s/w tool, depict Relation model in table format on Open source or commercialized DBMS using query language and introduce advance topics to interact with DBMS like view, trigger, procedures and aspects of authorization.

1. To elaborate use of conceptual database designs to prepare database schemas, indexing, transaction processing, concurrency and recovery control issues associated with database management systems.
2. To make the students aware of various relational database systems and the systematic approach to apply theoretical knowledge to design practical applications to solve real world problems on the small scale.
3. To make the students understand SQL and to use it efficiently to retrieve data from the database.

**Course Learning Outcomes:**

| CO | After the completion of the course the student should be able to | Bloom's Cognitive | |
|---|---|---|---|
| | | **level** | **Descriptor** |
| CO1 | **Interpret** the problem statement of an enterprise, identify the need, analyse the problem and design ER diagram for the enterprise as well as prepare the relational database schema for the enterprise identifying integrity constraints for efficient design using modern tools. | 3 | Applying |
| CO2 | **Apply** systematically theoretical knowledge to design practical applications to solve real world database problems on the small scale and theoretically justify the design and use fundamental transaction processing, concurrency control etc. in real applications. | 3 | Applying |
| CO3 | **Compare** and use various ways of writing the queries for a given problem and extract required information from the database. | 4 | Analyzing |

**CO-PO Mapping :**

| PO and PSO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | - | 2 | 2 | 2 | 2 | - | - | - | - | - | - | - | 3 | - |
| **CO2** | - | - | - | 2 | 3 | - | - | - | - | - | - | - | 3 | - |
| **CO3** | - | - | - | 3 | - | - | - | - | 2 | - | - | - | 3 | - |

*1: Low, 2: Medium, 3: High*

**Assessments :**

**Lab Assessment:**

There are four components of lab assessment, LA1, LA2, LA3 and Lab ESE.

IMP: Lab ESE is a separate head of passing.

| Assessment | Based on | Conducted by | Conduction and Marks Submission | Marks |
|---|---|---|---|---|
| LA1 | Lab activities, attendance, journal | Lab Course Faculty | During Week 1 to Week 4<br>Submission at the end of Week 5 | 25 |
| LA2 | Lab activities, attendance, journal | Lab Course Faculty | During Week 5 to Week 8<br>Submission at the end of Week 9 | 25 |
| LA3 | Lab activities, attendance, journal | Lab Course Faculty | During Week 10 to Week 14<br>Submission at the end of Week 14 | 25 |
| Lab ESE | Lab Performance and related documentation | Lab Course faculty | During Week 15 to Week 18<br>Submission at the end of Week 18 | 25 |

Week 1 indicates starting week of Semester.

Lab activities/Lab performance shall include performing experiments, mini-project, presentations, drawings, programming and other suitable activities, as per the nature and requirement of the lab course.

The experimental lab shall have typically 8-10 experiments.

**Course Contents:**

Assignments to be carried out in any RDBMS like ORACLE//DB2/SQL-Server/PostgreSQL:

Assignments include conceptual design using ER model, SQL and PL/SQL

1. Database Design using ER model
2. Database schema design
3. Database creation and applying integrity constraints
4. Study of DDL statements and data manipulation statements
5. Study of Basic SQL SELECT statement for displaying data from single table or multiple tables
6. Study of SQL constructs for aggregating data using group functions, sub-queries and complex queries
7. Study and Implementation of Triggers
8. Study and Implementation of Stored Procedures
9. Transaction isolation levels and Concurrency control
10. Few aspects of authorization such as creating and managing users, roles, granting and revoking of privileges
11. Implementation of B+ tree, hash index in C or C++

| **Title of the Course: Computer Network Lab**<br>**Course code: 5CS275** | L | T | P | Cr |
|---|---|---|---|---|
| | 0 | 0 | 2 | 1 |

**Desirable Requirements:** Data Communication

**Textbooks:**

1. Richard Steven, "Unix network programming", for Socket Programming, Prentice Hall ,3rd edition, 2015
2. James F. Kurose and Keith W. Ross, "Computer Networking: A Top-Down Approach Featuring the Internet", Pearson Education,5th /6th edition, 2012/2013

**References:**

1. Jeffery S. Beasley, "Networking", New Riders Press, 2nd edition, 2008.
2. Larry L. Peterson, Bruce S. Davie "Computer Networks: A Systems Approach", The Morgan Kaufmann Series in Networking, 5th edition, 2011.

**Course Objectives:** The course is designed to give the practical view of various networking concepts and protocols using tools and simulators**.**

1. To dig up theoretical and practical knowledge in computer networks.
2. To distinguish and show how to design and analyze different types of communication protocols.
3. To interpret basic skills needed to write network application using socket interface.

**Course Learning Outcomes:**

| **CO** | **After the completion of the course the student should be able to** | Bloom's Cognitive | |
|---|---|---|---|
| | | level | Descriptor |
| **CO1** | **Demonstrate** the practical aspect of networking related to the theoretical concepts. | 3 | Applying |
| **CO2** | Simulate, configure and **analyze** the network using networking tools. | 4 | Analyzing |

**CO-PO Mapping :**

| **PO and PSO** | **PO 1** | **PO 2** | **PO 3** | **PO 4** | **PO 5** | **PO 6** | **PO 7** | **PO 8** | **PO 9** | **PO 10** | **PO 11** | **PO 12** | **PSO1** | **PSO2** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | **1** | **-** | **-** | **2** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **1** | **-** |
| **CO2** | **-** | **-** | **-** | **-** | **3** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** |

*1: Low, 2: Medium, 3: High*

**Assessments :**

**Lab Assessment:**

There are four components of lab assessment, LA1, LA2, LA3 and Lab ESE.

IMP: Lab ESE is a separate head of passing.

| Assessment | Based on | Conducted by | Conduction and Marks Submission | Marks |
|---|---|---|---|---|
| LA1 | Lab activities, attendance, journal | Lab Course Faculty | During Week 1 to Week 4<br>Submission at the end of Week 5 | 25 |
| LA2 | Lab activities, attendance, journal | Lab Course Faculty | During Week 5 to Week 8<br>Submission at the end of Week 9 | 25 |
| LA3 | Lab activities, attendance, journal | Lab Course Faculty | During Week 10 to Week 14<br>Submission at the end of Week 14 | 25 |
| Lab ESE | Lab Performance and related documentation | Lab Course faculty | During Week 15 to Week 18<br>Submission at the end of Week 18 | 25 |



Week 1 indicates starting week of Semester.

Lab activities/Lab performance shall include performing experiments, mini-project, presentations, drawings, programming and other suitable activities, as per the nature and requirement of the lab course. The experimental lab shall have typically 8-10 experiments.

**Course Contents:**

At least 10 to 12 assignments should be conducted on following topics:

1. Study of Internetworking devices.
2. Study of basic networking commands and network configuration.
3. Study of packet capturing and analyzing tools on windows platform(e.g. Wireshark)
4. Wireshark Lab: Ethernet and ARP.
5. Wireshark Lab: 802.11
6. Configuration of network topology using packet tracer tool
7. Configuration of routing protocols
8. Configuration of IPv6 address using Packet Tracer
9. Capture and analyze TCP and UDP packet using Wireshark
10. Analyzing TCP connection and termination using Wireshark
11. Socket programming using TCP and UDP.
12. Wireshark Lab: HTTP, DNS

| **Title of the Course and Course code: Programming Lab 2**<br>**Course Code: 5CS276** | L | T | P | Cr |
|---|---|---|---|---|
| | 0 | 0 | 2 | 1 |

**Desirable Requirements:** Object Oriented Paradigm, Object Oriented Concept and basic implementation in C++.

**Textbooks:**

1. Cay S. Horstmann, Gary Cornell "Core Java Fundamentals Volume –I" (The Sun Microsystems Press Java Series), 10th Edition, March 2016
2. Cay S. Horstmann, Gary Cornell, "Core Java Volume – II" (The Sun Microsystems Press Java Series), 10th Edition, April 2017

**References:**

1. Herbert Schildt, "Java Complete Reference", McGraw Hill Education, 10th Edition, November 2017
2. Kathy Sierra and Bert Bates, "Oracle Certified Associates JAVA Standard Edition 8 Programmer I Exam Guide", McGraw Hill Education (Oracle Press), May 2017
3. Kathy Sierra and Bert Bates, "Oracle Certified Associates JAVA Standard Edition 8 Programmer II Exam Guide", McGraw Hill Education (Oracle Press), July 2018

**Course Objectives :**

Summary: Java is widely used in every corner of world and of human life. Java is not only used in software's but is also widely used in designing hardware controlling software components. JAVA programming language provides variety of data types, methods and some of them are included in syllabus. Learning Java serves as a good introduction to software development. Main objectives are as follows-

1. To inculcate the understanding of JAVA programming environment, basic object oriented programming with JAVA (JAVA version 1.8 and above or the latest java version)
2. To introduce selection of appropriate concepts of java programming such as static and non-static classes and access modifiers, user defined classes, collection, interface, exception handling, multi-threading, packages like – i/o, util, net, jdbc etc.
3. To infuse skills of integrating all components to build small java application for real world problem.

**Course Learning Outcomes:**

| **CO** | **After the completion of the course the student should be able to** | Bloom's Cognitive | |
|---|---|---|---|
| | | level | Descriptor |
| **CO1** | **Convert** the real world problem using simple java programing domain and identify the required java object oriented concept | 2 | Understanding |
| **CO2** | **Demonstrate** small application using java as a programing language for socio economic importance | 3 | Applying |

**CO-PO Mapping :**

| PO and PSO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | 2 | - | - | 3 | - | - | - | - | - | - | - | - | - |
| CO2 | 2 | 2 | 1 | - | 3 | - | - | - | - | - | - | - | - | - |

*1: Low, 2: Medium, 3: High*

**Assessments :**

**Lab Assessment:**

There are four components of lab assessment, LA1, LA2, LA3 and Lab ESE.

IMP: Lab ESE is a separate head of passing.

| Assessment | Based on | Conducted by | Conduction and Marks Submission | Marks |
|---|---|---|---|---|
| LA1 | Lab activities, attendance, journal | Lab Course Faculty | During Week 1 to Week 4<br>Submission at the end of Week 5 | 25 |
| LA2 | Lab activities, attendance, journal | Lab Course Faculty | During Week 5 to Week 8<br>Submission at the end of Week 9 | 25 |
| LA3 | Lab activities, attendance, journal | Lab Course Faculty | During Week 10 to Week 14<br>Submission at the end of Week 14 | 25 |
| Lab ESE | Lab Performance and related documentation | Lab Course faculty | During Week 15 to Week 18<br>Submission at the end of Week 18 | 25 |

Week 1 indicates starting week of Semester.

Lab activities/Lab performance shall include performing experiments, mini-project, presentations, drawings, programming and other suitable activities, as per the nature and requirement of the lab course.

The experimental lab shall have typically 8-10 experiments.

| Course Contents: | |
|---|---|
| **Module 1 - An Introduction to Java** | **3 Hrs.** |
| Features of JAVA language, Java Programming Environment-JDK, JRE, JVM, Fundamental Programming Structures in Java, Comparison of Java with C++, classes and objects, Inheritance and Interfaces.<br>**Experiments:**<br>**1.** Installation of jdk package, understand the difference between jdk and jre folder, set environment variable PATH/CLASSPATH.<br>**2.** Simple hello word program for understanding – java structure, command and steps for executing java program. Also simple program for reading input from user using scanner class.<br>**3.** Implementation of different inheritance types, Multiple Inheritance using Interface | |
| **Module 2 - Fundamentals of Java** | **5 Hrs.** |
| Use of keywords like final, static and abstract, Packages, String class, StringBuilder/StringBuffer class, Exception handling in Java<br>**Experiments:**<br>1. Implementation of Package and access mechanism in package<br>2. String class implementation, basic operation, creating immutable and mutable string<br>3. Exception Handling | |
| **Module 3 - I/O programming and util package** | **6 Hrs.** |
| Hierarchy of classes in I/O Package, Streams: Character oriented and Byte oriented, Reading basic data types from keyboard, File handling in Java. Utility Methods for Arrays.<br>The Collection Framework : List, Set, Map<br>**Experiments:**<br>1. Implement collection utility classes – list, set, map with their specific methods available in interface or implemented class.<br>2. Implement exception related to IO and collection classes.<br>3. Program to read basic data types from keyboard using Scanner and check the entered values data type for its appropriateness | |
| **Module 4 – Multithreading in Java** | **3 Hrs.** |
| Multithreading – Classes support thread creation and execution<br>Thread States & Synchronization of threads<br>**Experiments:**<br>1. Multithreading – display thread information.<br>2. Multithreading – create thread using Thread and Runnable class.<br>3. Multithreading – thread communication and synchronization of threads. | |
| **Module 5 - Java-Oracle database connectivity** | **4 Hrs.** |
| Introduction to JDBC (Oracle Connectivity)<br>JDBC Drivers & Initialization<br>Creating Connection and Connecting to Databases<br>CURD operation Using JDBC (Oracle Connectivity)<br>Performing operations on specific row in oracle database using JDBC<br>**Experiments:**<br>1. Design Database program for Employee details and implement INSERT, SELECT, DELETE, and UPDATE queries.<br>2. Implement ResultSet class.<br>3. Implement RowSet class. | |

| | |
|---|---|
| **Module 6 - Graphical user interface in Java** | **5 Hrs.** |
| GUI Design in Java – User Interface<br>Event Handling in Java - Event delegation model (MVC model)<br>Introduction to Swing.<br><br>**Experiments:**<br>1. GUI design and Event handling<br>2. GUI design using Swing package - a) Celsius to Fahrenheit conversion b) Login and Password Verification.<br>**3.** Implement exception related to event handling, GUI design. | |

# Presentation and Report Writing (5CS277)

# EVEN Semester

# Mandatory Life Skill Courses

# Environmental Sciences (5IC201)

# EVEN Semester

# Minor Specialization Courses

| Title of the Course: Software Engineering<br><br>Course Code: 1CSMO2 | L | T | P | Cr |
|---|---|---|---|---|
| | 3 | 0 | 0 | 3 |

**Desired requirements:**

**Textbooks:**

1. Pankaj Jalote, "An Integrated Approach to Software Engineering", Narosa Publishers, 3rd Edition, 2005.
2. Ian Sommerville, "Software Engineering", Addison-Wesley, 7th Edition, 2004.
3. James Rumbaugh, "Object Oriented Modeling and Design with UML", Pearson, 2nd Edition,2004.

**References:**

1. Roger S. Pressman, *"Software Engineering: Practitioner's Approach"*, McGraw Hill, 7th Edition, 2010.
2. Jawadekar W.S., *"Software Engineering: principles and practices"*, Tata McGraw Hills, 1st Edition.
3. Gillies A.C. and Smith p., *"Managing Software Engineering: CASE studies and solutions"*, Chapman and Hall, London.

**Course Objectives :**

1. To unleash the orientation & importance of engineering approach to software development.
2. To infuse the knowledge of software processes & models practiced at IT industries.
3. To acquaint students with the SDLC phases in detail.
4. To emphasize on Design aspect with UML technology.
5. To inculcate the importance of software quality by virtue of software testing methods.

**Course Learning Outcomes:**

| CO | After the completion of the course the student Learner be able to | Bloom's Cognitive | |
|---|---|---|---|
| | | level | Descriptor |
| **CO1** | Grasp industry processes on software development to become IT industry-savvy. | 2 | Understanding |
| **CO2** | Prepare with the spirit of team-working and importance of using artifacts at SDLC phases. | 3 | Applying |
| **CO3** | Distinguish and evaluate procedural & OO based development practices. | 4 | Analyzing |
| **CO4** | Integrate expertise on CASE tools usage especially for design and testing of software to undertake industrial strength software projects. | 6 | Creating |

**CO-PO Mapping :** *1: Low, 2: Medium, 3: High*

| PO and PSO | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | | | **2** | | | | | | | | **3** | **2** | **2** | |
| **CO2** | | | **1** | **2** | | | | **2** | **2** | **3** | | | | |
| **CO3** | | | | | **2** | | | | | | | | | |
| **CO4** | | | **2** | | | | | | | | | **2** | | **3** |

**Assessments :**

**Teacher Assessment:**

Two components of In Semester Evaluation (ISE), One Mid Semester Examination (MSE) and one End Semester Examination (ESE) having 20%, 30% and 50% weights respectively.

| Assessment | Marks |
|---|---|
| ISE 1 | 10 |
| MSE | 30 |
| ISE 2 | 10 |
| ESE | 50 |

ISE 1 and ISE 2 are based on pedagogy such as brainstorming, role play, quiz, presentations etc.
MSE: Assessment is based on 50% of course content (Normally first three modules)
ESE: Assessment is based on 100% course content with 70-80% weightage for course content (normally last three modules) covered after MSE.

**Course Contents:**

| | |
|---|---|
| **Module 1: Software Processes** | **6 Hrs.** |
| Need of software engineering approach, ETVX model, Project management process, Software development process & models, Configuration management process, Process management process. | |
| **Module 2: Software Quality & Project Planning** | **2 Hrs.** |
| Quality objectives, PAF Model, Quality standards CMM & ISO, Project management plan, Cost estimation using COCOMO, Risk management. | |
| **Module 3: Software Requirement Analysis & Function Oriented Design** | **2Hrs.** |
| Software requirement process, Characteristics & Components of SRS.<br>Design principles, Module level concepts. | |

| | |
|---|---|
| **Module 4: Object Oriented Design with UML Diagrams** | **2 Hrs.** |
| UML model, UML diagrams: Use-case, Class, Activity, State-chart, Interaction, Sequence, Collaboration, Component, Deployment. | |
| **Module 5: Coding** | **3Hrs.** |
| Best programming practices such as TDD & pair programming, verification. | |
| **Module 6: Software Testing** | **5Hrs.** |
| Testing purpose and concepts, test process, Levels of testing, Black Box and White Box Testing. | |

**Module wise Measurable Students Learning Outcomes :**
**The student should be able to:**

**Module 1: Software Processes**

- Awareness of Software processes & Models used at IT.

**Module 2: Software Quality & Project Planning**

- Grasp quality parameters and standards such as PAF.
- Know & prepare project planning phases and responsibilities with WBS.

**Module 3: Software Requirement Analysis & Function Oriented Design**

- As per SDLC phase understand requirement process and need of SRS artifact. Understand functional & non-functional requirements as well. Realize the importance of design aspects, concepts & methodology. Practices to learn how to draw DFD on requirements.

**Module 4:Object Oriented Design with UML & Continual Integration**

- Building capability to draw & distinguish various UML diagrams on requirements. Articulating usage of Continual integration with Agile model process frameworks.

**Module 5: User Interface Design & Coding**

- Know the UI aspect of interactive design for enterprise applications.
- Learn best coding standards/practices such as TDD, pair programming and how to verify code.

**Module 6: Software Testing**

- Integrate expertise on how testing helps in quality of software. Know testing concepts, levels of testing. Learn and practice Black & white box testing along with test case generations using open- source tools.

# This is Last Page

## Walchand College of Engineering, Sangli

*(Government Aided Autonomous Institute)*

**AY 2021-22**

| **Course Information** | |
|---|---|
| **Programme** | B.Tech. (Computer Science & Engineering) |
| **Class, Semester** | Third Year B. Tech., Sem V |
| **Course Code** | |
| **Course Name** | Compiler Design |
| **Desired Requisites:** | Formal Language and Automata Theory, Discrete Mathematics |

| **Teaching Scheme** | | **Examination Scheme (Marks)** | | | |
|---|---|---|---|---|---|
| **Lecture** | 3 Hrs/week | **T1** | **T2** | **ESE** | **Total** |
| **Tutorial** | - | 20 | 20 | 60 | 100 |
| **Practical** | - | | | | |
| **Interaction** | - | **Credits: 3** | | | |

| **Course Objectives** | |
|---|---|
| **1** | To introduce fundamentals of compiler design and various tools used to design a compiler |
| **2** | To inculcate role of various phases involved during design of a compiler and impart in depth working of each phase |
| **3** | To exercise design of various phases of a compiler using compiler design tools and techniques |

| **Course Outcomes (CO) with Bloom's Taxonomy Level** | | |
|---|---|---|
| At the end of the course, the students will be able to, | | |
| **CO1** | **Discuss** the need of compiler, fundamental concepts and various tools used to design a compiler. | Understanding |
| **CO2** | **Demonstrate** role and working of each phase involved during compilation. | Applying |
| **CO3** | **Analyze** the working of various phases of compiler. | Analyzing |
| **CO4** | **Assess** various phases of compiler using compiler design tools and techniques. | Evaluating |

| **Module** | **Module Contents** | **Hours** |
|---|---|---|
| I | **Module 1: Fundamentals of Compiler**<br>Overview- Structure of a compiler, applications of compiler, one pass and two pass compiler.<br>Lexical analysis - The role of a lexical analyzer, specification of tokens, recognition of tokens, LEX. | 6 |
| II | **Module 2 Syntax Analysis**<br>Context-free grammar, writing grammars for context free environments, parse trees and ambiguity, role of parser, specification and recognition of tokens, top-down parsing, recursive descent and predictive parsers (LL), bottom-up parsing, operator precedence parsing, LR, SLR and LALR parsers. | 9 |
| III | **Module 3 Syntax Directed Translation & Run time environments**<br>Syntax-directed definitions, evaluation orders for attributes of an SDD, S-attributed and L-attributed SDDs, construction of syntax tree, source language issues, storage organization and allocation strategies, parameter passing, symbol table organizations and generations, dynamic storage allocations. | 6 |
| IV | **Module 4 Intermediate Code Generation**<br>Intermediate languages, declarations, different intermediate representations –quadruples, triples, trees, flow graphs, SSA forms, and their uses; assignment statements and Boolean expressions, case statements, back patching, procedure calls. | 6 |

| | | |
|---|---|---|
| V | **Module 5 Code Optimization**<br>Sources of optimization, basic blocks and flow graphs, optimization of basic blocks, loops in flow graphs, loop optimization, machine-independent optimization, machine-dependent optimization, dead-code Elimination, code improving transformations. | 6 |
| VI | **Module 6 Code Generation**<br>Issues in the design of a code generator, run time storage management; simple code generator- register and address descriptors, code generation algorithm, design of the function getReg, DAG, peephole optimization, register allocation and assignment, selection of instruction, register allocation, parallel compilation, Just-in-Time compiler, study of compiler construction tools. | 7 |

**Text Books**

| | |
|---|---|
| 1 | D.M. Dhamdhere, *"Systems Programming and Operating Systems"*, Tata McGraw- Hill Publishing Company limited, New Delhi, Second revised Edition, 2005. |
| 2 | A.V. Aho, R. Shethi and J.D. Ullman, *"Compilers - Principles, Techniques and Tools"*, Pearson Education, Second Edition, 2007. |

**References**

| | |
|---|---|
| 1 | K Cooper, L Torczon, *"Engineering a Compiler"*, Morgan Kaufmann, Second Edition, 2011. |
| 2 | John J Donavan, *"System Programming*", Tata McGraw- Hill Publishing Company limited, New Delhi. |
| 3 | Sumitabha Das, *"Unix Concepts and Administration"*, TMGH, 3rd Edition. |
| 4 | A.V. Aho, R. Shethiand J.D. Ullman, *"Compilers - Principles, Techniques and Tools"*, Addison Wesley Publishing Company, 2007. |

**Useful Links**

| | |
|---|---|
| 1 | [Compiler Design - Course (nptel.ac.in)] |
| 2 | [NPTEL :: Computer Science and Engineering - Compiler Design] |

**CO-PO Mapping**

| | Programme Outcomes (PO) | | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 |
| **CO1** | 2 | - | - | - | - | - | - | - | - | - | - | - | 2 | - | - |
| **CO2** | 3 | - | - | - | - | - | - | - | - | - | - | - | 3 | - | - |
| **CO3** | - | 3 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| **CO4** | 2 | 2 | - | - | - | - | - | - | - | - | - | - | 3 | - | - |

The strength of mapping is to be written as 1,2,3; Where, 1:Low, 2:Medium, 3:High
Each CO of the course must map to at least one PO.

**Assessment (for Theory Course)**

The assessment is based on 2 in-semester examinations in the form of T1 (Test-1) and T2 (Test-2) of 20 marks each. Also there shall be 1 End-Sem examination (ESE) of 60 marks. T1 shall be typically on modules 1 and 2, T2 based typically on modules 3, 4 and ESE shall be on all modules with nearly 50% weightage on modules 1 to 4 and 50% weightage on modules 5, 6.

| Assessment Plan based on Bloom's Taxonomy Level (Marks) For Theory Course | | | | | |
|---|---|---|---|---|---|
| **Bloom's Taxonomy Level** | | **T1** | **T2** | **ESE** | **Total** |
| 1 | Remember | | | | |
| 2 | Understand | 15 | 10 | 15 | 40 |
| 3 | Apply | 5 | 5 | 20 | 30 |
| 4 | Analyze | | 5 | 20 | 25 |
| 5 | Evaluate | | | 5 | 5 |
| 6 | Create | | | | |
| **Total** | | **20** | **20** | **60** | **100** |

# Walchand College of Engineering, Sangli

*(Government Aided Autonomous Institute)*

**AY 2021-22**

| **Course Information** | |
|---|---|
| **Programme** | B.Tech. (Computer Science & Engineering) |
| **Class, Semester** | Third Year B. Tech., Sem V |
| **Course Code** | |
| **Course Name** | Design and Analysis of Algorithm |
| **Desired Requisites:** | Data structure |

| **Teaching Scheme** | | **Examination Scheme (Marks)** | | | |
|---|---|---|---|---|---|
| **Lecture** | 3 Hrs/week | **T1** | **T2** | **ESE** | **Total** |
| **Tutorial** | - | 20 | 20 | 60 | 100 |
| **Practical** | - | | | | |
| **Interaction** | - | **Credits: 3** | | | |

| **Course Objectives** | |
|---|---|
| **1** | To illustrate and apply the algorithm analysis techniques. |
| **2** | To discuss the efficient algorithm for various problem |
| **3** | To explain and demonstrate different algorithm techniques for real world problem |
| **4** | To compute and prove complexity class of various algorithm techniques |
| **5** | |

| **Course Outcomes (CO) with Bloom's Taxonomy Level** | | |
|---|---|---|
| **CO1** | Discuss the fundamentals of algorithm design and analysis techniques. | Understanding |
| **CO2** | Apply knowledge of computing and mathematics to algorithm design | Applying |
| **CO3** | Critically analyze the various algorithm design techniques for a given problem. | Analyzing |
| **CO4** | Classify computational problems into P, NP, NP-Hard and NP-Complete. | Evaluating |
| **CO5** | Design efficient algorithms to improve complexity of existing algorithm. | Creating |

| **Module** | **Module Contents** | **Hours** |
|---|---|---|
| I | **Introduction**<br>Introduction to Algorithm Analysis Time and Space Complexity, Elementary operations and Computation of Time Complexity-Best, worst and Average Case Complexities- Complexity Calculation of simple algorithms. Recurrence Equations: Solution of Recurrence Equations – Iteration Method and Recursion Tree Methods. Master's theorem for complexity computation. | 6 |
| II | **Divide and conquer**<br>Binary Search, Merge sort , Quick sort , Heap Sort , Multiplication of Large Integers, Closest-Pair and Convex, Hull Problems, Strassen's Matrix Multiplication. | 7 |
| III | **Greedy Technique**<br>Greedy Technique – Container loading problem, Job sequencing with deadlines, Minimum cost spanning trees, Knapsack problem, Optimal Merge pattern, Huffman Trees. | 6 |
| IV | **Dynamic Programming**<br>Principle of optimality – Coin changing problem, Computing a Binomial Coefficient – Floyd's algorithm – Multi stage graph – Optimal Binary Search Trees – 0/1 Knapsack problem and Memory functions. | 7 |

| | | |
|---|---|---|
| V | **Backtracking**<br>Backtracking-General method, applications The 4, 8-queen problem, sum of subsets problem, graph coloring, Hamiltonian cycles. | 6 |
| VI | **Graph Traversal Techniques & Class of problem**<br>Techniques for Graphs – Breadth First Search & Traversal, Depth First Search & Traversal, Topological sorting of DAGs AND/OR graphs, Connected components P, NP, NP- Complete and NP Hard Problems, Approximation Algorithms for NP-Hard Problems. | 7 |

| | |
|---|---|
| | **Text Books** |
| 1 | Ellis Horowitz, Sartaj Sahni and Rajasekaran "Fundamentals of Computer Algorithms" , Galgotia Publications, 2nd Edition. |
| 2 | Aho, Hopfcraft and Ullman, Addison Wesley "Design and Analysis of Algorithms", |
| | **References** |
| 1 | Thomas Cormen, Leiserson, Rivest, and Stein "Introduction to Algorithms", PHI Publication. 3rd Edition, 2009 |
| 2 | Goodman ,"Introduction to Design and Analysis of Algorithm", McGraw Hill. |
| 3 | R.C.T. Lee, S.S. Tseng, R.C. Chang, "Introduction to the Design and Analysis of Algorithm", Tata |
| | **Useful Links** |
| 1 | https://online.stanford.edu/courses/soe-ycsalgorithms1-algorithms-design-and-analysis-part-1 |

**CO-PO Mapping**

| | Programme Outcomes (PO) | | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 |
| **CO1** | 2 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | |
| **CO2** | 3 | 1 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | |
| **CO3** | -- | 3 | -- | 2 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | |
| **CO4** | -- | -- | -- | 2 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | |
| **CO5** | -- | -- | 3 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | |

The strength of mapping is to be written as 1,2,3; Where, 1:Low, 2:Medium, 3:High
Each CO of the course must map to at least one PO.

**Assessment (for Theory Course)**

The assessment is based on 2 in-semester examinations in the form of T1 (Test-1) and T2 (Test-2) of 20 marks each. Also there shall be 1 End-Sem examination (ESE) of 60 marks. T1 shall be typically on modules 1 and 2, T2 based typically on modules 3, 4 and ESE shall be on all modules with nearly 50% weightage on modules 1 to 4 and 50% weightage on modules 5, 6.

**Assessment Plan based on Bloom's Taxonomy Level (Marks) For Theory Course**

| Bloom's Taxonomy Level | | T1 | T2 | ESE | Total |
|---|---|---|---|---|---|
| 1 | Remember | | | | |
| 2 | Understand | 10 | 5 | | 15 |
| 3 | Apply | 5 | 8 | 15 | 28 |
| 4 | Analyze | 5 | 7 | 20 | 32 |
| 5 | Evaluate | | | 15 | 15 |
| 6 | Create | | | 10 | 10 |
| **Total** | | **20** | **20** | **60** | **100** |

| **Walchand College of Engineering, Sangli**<br>*(Government Aided Autonomous Institute)* | |
|---|---|
| **AY 2021-22** | |
| **Course Information** | |
| **Programme** | B.Tech. (Computer Science & Engineering) |
| **Class, Semester** | Third Year B. Tech., Sem V |
| **Course Code** | |
| **Course Name** | Design and Analysis of Algorithm Lab |
| **Desired Requisites:** | Data structure |

| **Teaching Scheme (Hrs)** | | **Examination Scheme (Marks)** | | | |
|---|---|---|---|---|---|
| **Lecture** | - | **LA1** | **LA2** | **ESE** | **Total** |
| **Tutorial** | - | 30 | 30 | 40 | 100 |
| **Practical** | 2 | | | | |
| **Interaction** | - | **Credits: 1** | | | |

| **Course Objectives** | |
|---|---|
| **1** | Learn key techniques for designing and analyzing algorithms. |
| **2** | Study fundamental concepts and notations used in Algorithm design. |
| **3** | Study and apply different algorithm design methods namely, greedy method, divide and conquer, dynamic programming and backtracking. |
| **4** | Study the Parallel architectures for designing parallel algorithms. |
| **5** | Design and analyze the complexities of various algorithms following |

| **Course Outcomes (CO) with Bloom's Taxonomy Level** | | |
|---|---|---|
| **CO1** | Practice different algorithm techniques for given problem. | Applying |
| **CO2** | Identify appropriate data structure to implement selected algorithmic approach | Analyzing |
| **CO3** | Design and Implement an algorithm for complex problem in polynomial time. | Creating |
| **CO4** | Exhibit technical and professional skill to demonstrate and convince accomplished algorithmic solution. | Applying |

**List of Experiments / Lab Activities**

**List of Experiments:**

Students will be given hands on experience to design and implement efficient and effective algorithms for various problems based on syllabus covered in the course Design and Analysis of Algorithm in the
Practical hours using any suitable programming language like C, C++,Java. The List of experiments may include 12 to 14 experiments from among the following-
1. To implement sorting algorithm using array as a data structure and analyse its time complexity for
different values of n. The large number of elements may be generated using Random Number generator or may be stored in a file. (Quick Sort, Merge Sort)
2. To implement different search techniques using array and/or trees and analyze their time complexity. (Linear, Binary, Binary recursive)
3. To implement Fractional Knapsack problem and activity selection problem using Greedy method.
4. Find Minimum Cost Spanning Tree of a given undirected graph using Kruskal's& Prim's

| |
|---|
| algorithm<br>and compare.<br>5. To apply Greedy method to solve problems of<br>a) Job sequencing with deadlines<br>b) Optimal storage on tapes<br>6. Implement the following using Dynamic Programming<br>a) Matrix-chain multiplication<br>b) Longest common subsequence<br>c) Optimal binary search trees<br>7. To implement Strassen's matrix multiplication algorithm<br>8. From a given vertex in a weighted connected graph, find shortest paths to other vertices using<br>Dijkstra's algorithm.<br>9. Find a subset of a given set S = {s1,s2,.....,sn} of n positive integers whose sum is equal to a given<br>positive integer d. For example, if S= {1, 2, 5, 6, 8} and d = 9 there are two solutions {1,2,6} and<br>{1,8}. A suitable message is to be displayed if the given problem instance doesn't have a solution.<br>10. Implement any scheme to find the optimal solution for the Traveling Salesperson problem and then<br>solve the same problem instance using any approximation algorithm and determine the error in the<br>approximation.<br>11. Implement the following using Back Tracking<br>a) 8-Queen's problem<br>b) Hamiltonian cycle<br>c) Graph coloring Problem<br>12. Write a program to<br>a) Print all the nodes reachable from a given starting node in a digraph using BFS method.<br>b) Check whether a given graph is connected or not using DFS method.<br>13. Implement All-Pairs Shortest Paths Problem using Floyd's algorithm. Parallelize this algorithm by<br>creating multiple threads and determine the speed-up achieved.<br>14. Compare and evaluate the performance of different Randomization and Approximation algorithms |

| **Text Books** | |
|---|---|
| 1 | Ellis Horowitz, Sartaj Sahni and Rajasekaran "Fundamentals of Computer Algorithms" , Galgotia Publications, 2nd Edition. |
| 2 | Aho, Hopfcraft and Ullman, Addison Wesley "Design and Analysis of Algorithms", |
| 3 | |
| 4 | |
| | |
| **References** | |
| 1 | Thomas Cormen, Leiserson, Rivest, and Stein "Introduction to Algorithms", PHI Publication. 3rd Edition, 2009 |
| 2 | Goodman ,"Introduction to Design and Analysis of Algorithm", McGraw Hill. |
| 3 | R.C.T. Lee, S.S. Tseng, R.C. Chang, "Introduction to the Design and Analysis of Algorithm", Tata |
| 4 | |
| | |
| **Useful Links** | |
| 1 | https://online.stanford.edu/courses/soe-ycsalgorithms1-algorithms-design-and-analysis-part-1 |
| 2 | |
| 3 | |
| 4 | |

| CO-PO Mapping | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Programme Outcomes (PO) | | | | | | | | | | | | PSO | | |
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 |
| **CO1** | -- | -- | 2 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | |
| **CO2** | -- | 3 | -- | 2 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | |
| **CO3** | -- | -- | 3 | 1 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | |
| **CO4** | -- | -- | -- | 2 | -- | -- | -- | 2 | 2 | 2 | -- | 2 | -- | -- | |

The strength of mapping is to be written as 1,2,3; Where, 1:Low, 2:Medium, 3:High
Each CO of the course must map to at least one PO.

**Assessment**

There are three components of lab assessment, LA1, LA2 and Lab ESE.
IMP: Lab ESE is a separate head of passing. LA1, LA2 together is treated as In-Semester Evaluation.

| Assessment | Based on | Conducted by | Typical Schedule (for 26-week Sem) | Marks |
|---|---|---|---|---|
| LA1 | Lab activities, attendance, journal | Lab Course Faculty | During Week 1 to Week 6 Marks Submission at the end of Week 6 | 30 |
| LA2 | Lab activities, attendance, journal | Lab Course Faculty | During Week 7 to Week 12 Marks Submission at the end of Week 12 | 30 |
| Lab ESE | Lab activities, attendance, journal | Lab Course Faculty | During Week 15 to Week 18 Marks Submission at the end of Week 18 | 40 |

Week 1 indicates starting week of a semester. The typical schedule of lab assessments is shown, considering a 26-week semester. The actual schedule shall be as per academic calendar. Lab activities/Lab performance shall include performing experiments, mini-project, presentations, drawings, programming and other suitable activities, as per the nature and requirement of the lab course. The experimental lab shall have typically 8-10 experiments.

**Assessment Plan based on Bloom's Taxonomy Level (Marks) (For lab Courses)**

| Bloom's Taxonomy Level | LA1 | LA2 | Lab ESE | Total |
|---|---|---|---|---|
| Remember | | | | |
| Understand | | | | |
| Apply | 15 | 10 | 15 | **40** |
| Analyze | 10 | 10 | 15 | **35** |
| Evaluate | | | | |
| Create | 5 | 10 | 10 | **25** |
| **Total Marks** | **30** | **30** | **40** | **100** |

# Walchand College of Engineering, Sangli

*(Government Aided Autonomous Institute)*

**AY 2021-22**

| **Course Information** | |
|---|---|
| **Programme** | B.Tech. (Computer Science and Engineering) |
| **Class, Semester** | Third Year B. Tech., Sem V |
| **Course Code** | |
| **Course Name** | Programming Laboratory-3 |
| **Desired Requisites:** | Basics of Object-Oriented Programming |

| **Teaching Scheme (Hrs)** | | **Examination Scheme (Marks)** | | | |
|---|---|---|---|---|---|
| **Lecture** | - | **LA1** | **LA2** | **ESE** | **Total** |
| **Tutorial** | - | 30 | 30 | 40 | 100 |
| **Practical** | 2 | | | | |
| **Interaction** | - | **Credits: 1** | | | |

| **Course Objectives** | |
|---|---|
| **1** | to inculcate understanding of World Wide Web, Internet, the concepts of web applications development and web programming languages. |
| **2** | to introduce selection of appropriate concepts of internet and web programming such as HTML, CSS, JavaScript, and other server-side scripting languages. |
| **3** | to infuse skills of combining different components and technologies to design a web application for real world problem. |

| **Course Outcomes (CO) with Bloom's Taxonomy Level** | | |
|---|---|---|
| **CO1** | summarize the different concepts and components of WWW, web development technologies and web security. | Understanding |
| **CO2** | illustrate the concepts of different web development technologies using different web development tools. | Applying |
| **CO3** | test the components of WWW, HTML tags, CSS properties, client-side and server-side programming concepts, web data representation formats and AJAX components using different web development tools. | Analyzing |
| **CO4** | classify the components of WWW, HTML tags, CSS properties, client-side and server-side programming concepts, web data representation formats, AJAX components and web security threats and measures. | Evaluating |
| **CO5** | build a web application, individually or in a team by combining different web development technologies and web security measures for real world problems using different web development tools. | Creating |

**List of Experiments / Lab Activities**

**Module 1: Introduction to World Wide Web**

Client, Server, Communication, Protocols, Ports, Client-Server Architectures, Internet, World Wide Web, HTTP, HTTP Status Codes, Web Clients/Browsers, and Web Servers.

**Experiments:**

1. Describe client, server, communication, ports, protocols, HTTP, browsers and web servers.
2. Distinguish between client and server, Internet, WWW, and client-server architectures.
3. Get header information of a web page using browser's developer mode.
4. Installation of web server.

**Module 2: Markup Languages and Building Web Pages**

Introduction to Markup Languages, Introduction to HTML and HTML5, Fundamental HTML Elements, HTML Forms, HTML Media, HTML Graphics, HTML APIs, HTML Web Components.

**Experiments:**

1. Design and develop web pages using fundamental HTML elements, such as head, title, body, header, comment, etc.
2. Design and develop web pages using HTML Formatting elements, such as abbr, address, etc.

3. Design and develop HTML Forms using HTML Form and Input elements, such as form, input, textarea, etc.
4. Design and develop web pages that embed images and client-side maps, audio and video and links, lists and tables.
5. Design and develop web pages with styles, semantics and layouts, such as header, footer, section, data, div, etc.
6. Design and develop web pages to embed YouTube videos, graphics using canvas and SVG.
7. Design and develop web pages using HTML APIs, web components.

**Module 3: Style sheet Languages and Presentation of Web Pages**
Introduction to style sheet languages, Introduction to Cascading Style Sheet (CSS), Text Formatting, Colours and Backgrounds, Borders and Margins, Floating and Positioning, Page Layout, Navigation Bars and Dropdowns, CSS Selectors.
**Experiments:**
1. Design and develop web pages by applying CSS text formatting properties, such as Text Alignment, Text Decoration, Text Transformation, Text Spacing, Text Shadow, Font Family, Font Style, Font Size, etc.
2. Design and develop web pages by applying CSS colors and backgrounds properties, such as colour, RGB, HEX, HSL values, background image, background color, etc.
3. Design and develop web pages by applying CSS borders and margin properties, such as Border Width, Border Color, Margins, etc.
4. Design and develop web pages by applying CSS floating, overflow and positioning properties, such as float, overflow, position, etc.
5. Design and develop web pages by applying CSS page layout properties, such as display, padding, height, width, max-width, align, etc.
6. Design and develop web pages by applying CSS properties to links, lists and tables.
7. Design and develop web pages by using CSS navigation bars and dropdowns.
8. Design and develop web pages by using CSS Selectors.
9. Design and develop web pages by using inline CSS, internal CSS and external CSS.

**Module 4: Client-side Programming**
JavaScript: Introduction to JavaScript, Basic Syntax, Variables, Data Types, Statements, Operators, Conditions, Loops, Functions, Arrays, Objects, Form Validation, DOM, JavaScript Objects, JavaScript Functions, Asynchronous JavaScript and any one of the state-of-the-art JavaScript libraries.
**Experiments:**
1. Implement a script using JavaScript that changes HTML content, HTML attributes hides and show HTML elements, HTML output and window alert box for web pages.
2. Implement a script using JavaScript that shows use of JavaScript variables, data types and statements for web pages.
3. Implement a script using JavaScript that shows use of JavaScript Arithmetic, Assignment and String Concatenation operations for web pages.
4. Implement a script using JavaScript that shows use of JavaScript conditionals and loops for web pages.
5. Implement a script using JavaScript that shows use of JavaScript Functions, Arrays, and Objects for web pages.
6. Implement a script using JavaScript that shows use of Asynchronous JavaScript.
7. Design and develop web pages and insert JavaScript in head tag, body tag, external file, external URL and external folder.
8. Implement a script using JavaScript library.

**Module 5: Server-side Programming**
Introduction to Server-side Programming, Installation of Web and database Server, Process user input, Efficient storage and delivery of information to and from databases, File handling and controlled access to the content, store session/state information, cookies, notifications and communication.
**Note:**
1. One of the following server-side scripting languages can be used for the implementation: PHP, Node.js, or other state-of-art scripting languages.
2. One of the following databases can be used for data storage and retrieval: MySQL, MongoDB, Firebase or other state-of-art databases.

**Experiments:**
1. Installation and configuration of web server and database server.
2. Implement basic functionalities of server-side scripting language, such as data types, operators,

conditionals, and loops.

3. Implement basic functionalities of server-side scripting language, such as objects, arrays, and functions.
4. Implement web page form validations using server-side scripting language.
5. Implement file handling using server-side scripting language.
6. Implement cookies using server-side scripting language.
7. Implement sessions using server-side scripting language.
8. Implement CRUD operations on database using server-side scripting language.

**Module 6: Representation of Web Data, AJAX and Web Security**

XML: Introduction to XML, Basics of XML, DTD, Namespaces, XHTML, XPath, XLinks, XQuery and XSLT.

JSON: Introduction to JSON, JSON vs XML, Syntax, Data Types, Parse, Stringify, Objects and Arrays, JSON in HTML.

AJAX: Introduction to AJAX, XMLHttpRequest, AJAX XML, AJAX PHP, and AJAX Database.

Web Security: Introduction, types of web threats, and prevention measures.

**Experiments:**

1. Create a XML file and display in the browser.
2. Create a XML file with the help of namespaces and display in the browser.
3. Create a DTD file and display in the browser.
4. Create and display XSLT file using XML and display in the browser.
5. Create XSLT file using XPath and XPointer and display in the browser.
6. Create a hyperlink using XLinks and display in the browser.
7. Create and display JSON files in HTML.
8. Create a JSON file using basic concepts and use it in HTML.
9. Extract and display the information using XQuery.
10. Implement an AJAX Request-Response with server.
11. Implement an AJAX Request-Response using PHP.
12. Implement an AJAX Request-Response with database.
13. Implementing basic security measures in web development.

| Text Books | |
|---|---|
| 1 | Jennifer Niederst Robbins, “Learning Web Design: A Beginner's Guide to HTML, CSS, JavaScript, and Web Graphics”, O'Reilly Media, 5th Edition, 2018, ISBN-13: 978-1491960202. |
| 2 | Robin Nixon, “Learning PHP, MySQL & JavaScript with j Query, CSS & HTML5”, O’Reilly Media, 5th Edition, 2018, ISBN-13: 978-9352130153 |
| 3 | |
| 4 | |

| References | |
|---|---|
| 1 | Robert W. Sebesta, “Programming the World Wide Web”, Pearson, 8th Edition, 2015, ISBN-13: 9780133776058 |
| 2 | Terry Ann Felke-Morris, “Basics of Web Design: HTML5 & CSS”, Pearson, 5th Edition, 2019, ISBN-13: 9780133970746 |
| 3 | Elliotte Harold, W. Means, “XML in a Nutshell, A Desktop Quick Reference”, O'Reilly Media 3rd Edition, 2004, ISBN-13: 9780596007645. |
| 4 | |

| Useful Links | |
|---|---|
| 1 | https://www.w3schools.com/ |
| 2 | https://www.javatpoint.com/ |
| 3 | https://developer.mozilla.org/en-US/docs/Web |
| 4 | |

| CO-PO Mapping | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Programme Outcomes (PO) | | | | | | | | | | | | PSO | | |
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | |

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 2 | 1 | | | | 1 | | | | | | | | | |
| **CO2** | 3 | 2 | 2 | 3 | 3 | | | | | | | | | 1 | |
| **CO3** | | 3 | | 2 | 2 | | | | | | | | | | |
| **CO4** | | 2 | | 2 | 3 | 1 | | | | | | | | | |
| **CO5** | | | 3 | 2 | 3 | 1 | | | 3 | | | | | 2 | |

The strength of mapping is to be written as 1,2,3; Where, 1: Low, 2: Medium, 3: High
Each CO of the course must map to at least one PO.

**Assessment**

There are three components of lab assessment, LA1, LA2 and Lab ESE.
IMP: Lab ESE is a separate head of passing. LA1, LA2 together is treated as In-Semester Evaluation.

| Assessment | Based on | Conducted by | Typical Schedule (for 26-week Sem) | Marks |
|---|---|---|---|---|
| LA1 | Lab activities, attendance, journal | Lab Course Faculty | During Week 1 to Week 6<br>Marks Submission at the end of Week 6 | 30 |
| LA2 | Lab activities, attendance, journal | Lab Course Faculty | During Week 7 to Week 12<br>Marks Submission at the end of Week 12 | 30 |
| Lab ESE | Lab activities, attendance, journal | Lab Course Faculty | During Week 15 to Week 18<br>Marks Submission at the end of Week 18 | 40 |

Week 1 indicates starting week of a semester. The typical schedule of lab assessments is shown, considering a 26-week semester. The actual schedule shall be as per academic calendar. Lab activities/Lab performance shall include performing experiments, mini-project, presentations, drawings, programming and other suitable activities, as per the nature and requirement of the lab course. The experimental lab shall have typically 8-10 experiments.

**Assessment Plan based on Bloom’s Taxonomy Level (Marks) (For lab Courses)**

| Bloom’s Taxonomy Level | LA1 | LA2 | Lab ESE | Total |
|---|---|---|---|---|
| Remember | | | | |
| Understand | 5 | 5 | 5 | **10** |
| Apply | 15 | 15 | 10 | **40** |
| Analyze | 5 | 5 | 5 | **15** |
| Evaluate | 5 | 5 | 5 | **15** |
| Create | | | 15 | **15** |
| **Total Marks** | **30** | **30** | **40** | **100** |

# Walchand College of Engineering, Sangli

*(Government Aided Autonomous Institute)*

**AY 2021-22**

| Course Information | |
|---|---|
| **Programme** | B.Tech. (Computer science and engineering) |
| **Class, Semester** | Third Year B. Tech., Sem V |
| **Course Code** | |
| **Course Name** | Mini Project – 1 |
| **Desired Requisites:** | Nil |

| **Teaching Scheme** | | **Examination Scheme (Marks)** | | | |
|---|---|---|---|---|---|
| **Lecture** | - | **LA1** | **LA2** | **ESE** | **Total** |
| **Tutorial** | - | 30 | 30 | 40 | 100 |
| **Practical** | 2 | | | | |
| **Interaction** | - | **Credits: 1** | | | |

| **Course Objectives** | |
|---|---|
| **1** | To use latest design and development tools |
| **2** | To undergo project management techniques and project design principles. |
| **3** | To implement the project with appropriate programming languages and testing tools |
| **4** | To develop analytical vision and skills to analyse, compare the outcome with other techniques |

| **Course Outcomes (CO) with Bloom's Taxonomy Level** | | |
|---|---|---|
| **CO1** | demonstrate present technological trends through seminar and presentation | Remember |
| **CO2** | demonstrate the appropriate selection of software tool for project implementation | Understand |
| **CO3** | work in teams and participate in group activity of software development. | Apply |
| **CO4** | develop a software product and demonstrate its significance | Evaluate |

## List of Experiments / Lab Activities

**List of Experiments:**

1. The theme of **Mini Project 1 should be based on current or previous semester courses completed, focus should be more on the courses which doesn't have lab course**.
2. Students should maintain a project log book containing weekly progress of the project
3. At the end of the semester project group should achieve all the proposed objectives of the problem statement.
4. The work should be completed in all aspects of design, implementation and testing.
5. Project report should be prepared and submitted in soft and hard form along with all the code and datasets.
6. Group should demonstrate the work with various test cases and results obtained and explain future scope.
7. The group should participate in technical symposiums, paper presentations to demonstrate their work and findings in technical community.

| **Text Books** | |
|---|---|
| 1 | Nil |
| 2 | |
| 3 | |
| 4 | |

| **References** | |
|---|---|
| 1 | Nil |
| 2 | |
| 3 | |
| 4 | |

| Useful Links | |
|---|---|
| 1 | Nil |
| 2 | |
| 3 | |
| 4 | |

| CO-PO Mapping | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Programme Outcomes (PO) | | | | | | | | | | | | PSO | | |
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 |
| **CO1** | 2 | | | | | | | | | | | | 3 | 3 | |
| **CO2** | 2 | 3 | | | | | | | | | | | 3 | 3 | |
| **CO3** | | 2 | | 3 | 2 | | | | | | | | 2 | | |
| **CO4** | 2 | | | | | | | | | | 3 | | | 3 | |

The strength of mapping is to be written as 1,2,3; Where, 1:Low, 2:Medium, 3:High
Each CO of the course must map to at least one PO.

## Assessment

There are four components of lab assessment, LA1, LA2, LA3 and LA4
IMP: LA4 is a separate head of passing. LA4 is treated as End Semester Exam and is based on all experiments/lab activities.

| Assessment | Based on | Conducted by | Typical Schedule | Marks |
|---|---|---|---|---|
| LA1 | Lab activities, attendance, journal | Lab Course Faculty | During Week 1 to Week 4<br>Marks Submission at the end of Week 5 | 25 |
| LA2 | Lab activities, attendance, journal | Lab Course Faculty | During Week 5 to Week 8<br>Marks Submission at the end of Week 9 | 25 |
| LA3 | Lab activities, attendance, journal | Lab Course Faculty | During Week 10 to Week 14<br>Marks Submission at the end of Week 14 | 25 |
| LA4 | Lab Performance and documentation | Lab Course faculty | During Week 15 to Week 18<br>Marks Submission at the end of Week 18 | 25 |

Week 1 indicates starting week of Semester.
Lab activities/Lab performance shall include performing experiments, mini-project, presentations, drawings, programming and other suitable activities, as per the nature and requirement of the lab course. The experimental lab shall have typically 8-10 experiments.

| Bloom's Taxonomy Level | LA1 | LA2 | ESE | Total |
|---|---|---|---|---|
| Remember | 15 | | | **15** |
| Understand | 15 | 10 | 5 | **30** |
| Apply | | 15 | 15 | **30** |
| Analyze | | | | |
| Evaluate | | 10 | 15 | **25** |
| Create | | | | |
| **Total** | **30** | **30** | **40** | **100** |

# Walchand College of Engineering, Sangli

*(Government Aided Autonomous Institute)*

## AY 2021-22

| Course Information | |
|---|---|
| **Programme** | B.Tech. (Computer Science and Engineering) |
| **Class, Semester** | Third Year B. Tech., Sem V |
| **Course Code** | |
| **Course Name** | Mini Project – 2 |
| **Desired Requisites:** | Nil |

| **Teaching Scheme** | | **Examination Scheme (Marks)** | | | |
|---|---|---|---|---|---|
| **Lecture** | - | **LA1** | **LA2** | **ESE** | **Total** |
| **Tutorial** | - | 30 | 30 | 40 | 100 |
| **Practical** | 2 | | | | |
| **Interaction** | - | **Credits: 1** | | | |

| **Course Objectives** | |
|---|---|
| **1** | To use latest design and development tools |
| **2** | To undergo project management techniques and project design principles. |
| **3** | To implement the project with appropriate programming languages and testing tools |
| **4** | To develop analytical vision and skills to analyse, compare the outcome with other techniques |

| **Course Outcomes (CO) with Bloom's Taxonomy Level** | | |
|---|---|---|
| **CO1** | demonstrate present technological trends through seminar and presentation | Remember |
| **CO2** | demonstrate the appropriate selection of software tool for project implementation | Understand |
| **CO3** | work in teams and participate in group activity of software development. | Apply |
| **CO4** | develop a software product and demonstrate its significance | Evaluate |

### List of Experiments / Lab Activities

**List of Experiments:**

1. **Mini Project 2 should be on customer specific requirement useful to real life, major focus should be on Machine learning / Image Processing / Internet (Web) of Things (Preference should give to the course which are not covered in previous Miniproject 1 task).**
2. **.**
3. Students should maintain a project log book containing weekly progress of the project
4. At the end of the semester project group should achieve all the proposed objectives of the problem statement.
5. The work should be completed in all aspects of design, implementation and testing.
6. Project report should be prepared and submitted in soft and hard form along with all the code and datasets.
7. Group should demonstrate the work with various test cases and results obtained and explain future scope.
8. The group should participate in technical symposiums, paper presentations to demonstrate their work and findings in technical community.

| **Text Books** | |
|---|---|
| 1 | Nil |
| 2 | |
| 3 | |
| 4 | |

| **References** | |
|---|---|
| 1 | Nil |
| 2 | |
| 3 | |

| 4 | |
|---|---|
| | |

| Useful Links | |
|---|---|
| 1 | Nil |
| 2 | |
| 3 | |
| 4 | |

| CO-PO Mapping | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Programme Outcomes (PO) | | | | | | | | | | | | PSO | | |
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 |
| **CO1** | 2 | | | | | | | | | | | | 3 | 3 | |
| **CO2** | 2 | 3 | | | | | | | | | | | 3 | 3 | |
| **CO3** | | 2 | | 3 | 2 | | | | | | | | 2 | | |
| **CO4** | 2 | | | | | | | | | | 3 | | | 3 | |
| The strength of mapping is to be written as 1,2,3; Where, 1:Low, 2:Medium, 3:High<br>Each CO of the course must map to at least one PO. | | | | | | | | | | | | | | | |

**Assessment**

There are three components of lab assessment, LA1, LA2 and Lab ESE.
IMP: Lab ESE is a separate head of passing. LA1, LA2 together is treated as In-Semester Evaluation.

| Assessment | Based on | Conducted by | Typical Schedule (for 26-week Sem) | Marks |
|---|---|---|---|---|
| LA1 | Lab activities, attendance, journal | Lab Course Faculty | During Week 1 to Week 6<br>Marks Submission at the end of Week 6 | 30 |
| LA2 | Lab activities, attendance, journal | Lab Course Faculty | During Week 7 to Week 12<br>Marks Submission at the end of Week 12 | 30 |
| Lab ESE | Lab activities, attendance, journal | Lab Course Faculty | During Week 15 to Week 18<br>Marks Submission at the end of Week 18 | 40 |

Week 1 indicates starting week of a semester. The typical schedule of lab assessments is shown, considering a 26-week semester. The actual schedule shall be as per academic calendar. Lab activities/Lab performance shall include performing experiments, mini-project, presentations, drawings, programming and other suitable activities, as per the nature and requirement of the lab course. The experimental lab shall have typically 8-10 experiments.

| Bloom's Taxonomy Level | LA1 | LA2 | ESE | Total |
|---|---|---|---|---|
| Remember | 15 | | | 15 |
| Understand | 15 | 10 | 5 | 30 |
| Apply | | 15 | 15 | 30 |
| Analyze | | | | |
| Evaluate | | 10 | 15 | 25 |
| Create | | | | |
| **Total** | **30** | **30** | **40** | **100** |

| Walchand College of Engineering, Sangli<br>*(Government Aided Autonomous Institute)* | |
|---|---|
| **AY 2021-22** | |
| **Course Information** | |
| **Programme** | B.Tech. (Computer Science and Engineering) |
| **Class, Semester** | Third Year B. Tech, Sem V |
| **Course Code** | |
| **Course Name** | Image Processing |
| **Desired Requisites:** | |

| **Teaching Scheme** | | **Examination Scheme (Marks)** | | | |
|---|---|---|---|---|---|
| **Lecture** | 3 Hrs/week | **T1** | **T2** | **ESE** | **Total** |
| **Tutorial** | - | 20 | 20 | 60 | 100 |
| **Practical** | - | | | | |
| **Interaction** | - | **Credits: 3** | | | |

| **Course Objectives** | |
|---|---|
| **1** | To learn fundamental of digital image processing |
| **2** | To learn the concepts of image enhancement, image segmentation, compression etc and apply the<br>algorithms to build applications |
| **3** | To compare various algorithms and select the appropriate for a particular application. |
| **4** | To create initial background of the area of Image Processing to excel in this stream for further research. |
| **5** | To develop engineering skills and intuitive understanding of the tools used in Image Processing. |

**Course Outcomes (CO) with Bloom's Taxonomy Level**

At the end of the course, the students will be able to,

| | | |
|---|---|---|
| **CO1** | Discuss general terminology of digital image processing. | Understanding |
| **CO2** | Apply and demonstrate image processing algorithms in practical applications | Applying |
| **CO3** | Illustrate and critique different techniques employed for the enhancement, segmentation, morphology and compression of images | Evaluating |

| Module | Module Contents | Hours |
|---|---|---|
| I | **Digital Image Fundamentals**<br>Introduction and applications, Fundamental Steps and Components of Image Processing System<br>Digital Image Fundamentals: Image Acquisition, A simple image model, Sampling and<br>Quantization, Imaging Geometry, Different types of digital images | 6 |
| II | **Image Transforms**<br>2D systems and Necessary Mathematical preliminaries, 2D Orthogonal and Unitary Transforms, DFT, KL-Transforms, Cosine, Hadamard Transforms, Introduction to Wavelet Transforms | 6 |
| III | **Image Enhancement**<br>Point Processing, Basic Gray Level Transformations, Histogram Processing, Spatial domain Filtering, Frequency domain filtering | 6 |
| IV | **Image Segmentation and Analysis**<br>Edge Detection – using first and second order derivatives, LoG, Canny edge detector,<br>Boundary Extraction – Connectivity, Heuristic Graph Search, Hough Transform, Active<br>Contour, Watershed Transform, Region-based Segmentation – region growing, region | 8 |

| | | |
|---|---|---|
| | splitting and merging, Feature Extraction | |
| V | **Morphological Image Processing**<br>Mathematical Morphology, Erosion and Dilation, Opening and Closing, Hit-or-Miss transformation, Basic morphological algorithm: Boundary extraction, Hole filling, Extracting of connected components. Thinning, Thickening | 7 |
| VI | **Image Compression**<br>Fundamentals, Compression model, Lossless Vs Lossy Compression, Fundamentals of<br>Information Theory, Run-length coding, Huffman coding, Dictionary-based compression,<br>Predictive coding, Transform-based coding, Image Compression Standards | 6 |

| **Text Books** | |
|---|---|
| 1 | R. C. Gonzalez, R. E. Woods, Digital Image Processing, 4th Edition. 2018, PHI |
| 2 | A. K. Jain, Fundamentals of Digital Image Processing, PHI |

| **References** | |
|---|---|
| 1 | Milan Sonka, Vaclav Hlavac, Boyle, Digital Image Processing and Computer Vision, Cengage Learning |
| 2 | S. Jayaraman, S. Esakkirajan, T. Veerkumar, Digital Image Processing, Tata McGrawHill |
| 3 | Rafael C. Gonzalez, Richard E. Woods, Steven L. Eddins, Digital Image Processing Using MATLAB, 2nd ed. |

| **Useful Links** | |
|---|---|
| 1 | NPTEL course: Link |
| 2 | NPTEL course: Link |

**CO-PO Mapping**

| | **Programme Outcomes (PO)** | | | | | | | | | | | | **PSO** | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 |
| **CO1** | | 2 | | | | | | | | | | | | | |
| **CO2** | 3 | | 2 | | | | | | | | | | | | |
| **CO3** | 1 | | | 2 | | | | | | | | | | | |

1:Low, 2:Medium, 3:High

**Assessment (for Theory Course)**

The assessment is based on 2 in-semester examinations in the form of T1 (Test-1) and T2 (Test-2) of 20 marks each. Also there shall be 1 End-Sem examination (ESE) of 60 marks. T1 shall be typically on modules 1 and 2, T2 based typically on modules 3, 4 and ESE shall be on all modules with nearly 50% weightage on modules 1 to 4 and 50% weightage on modules 5, 6.

**Assessment Plan based on Bloom's Taxonomy Level (Marks) For Theory Course**

| **Bloom's Taxonomy Level** | | **T1** | **T2** | **ESE** | **Total** |
|---|---|---|---|---|---|
| 1 | Remember | | | | |
| 2 | Understand | 10 | 5 | 15 | 30 |
| 3 | Apply | 10 | 10 | 20 | 40 |
| 4 | Analyze | | | | |
| 5 | Evaluate | | 5 | 25 | 30 |
| 6 | Create | | | | |
| **Total** | | **20** | **20** | **60** | **100** |

# Walchand College of Engineering, Sangli

*(Government Aided Autonomous Institute)*

**AY 2021-22**

| **Course Information** | |
|---|---|
| **Programme** | B.Tech. (Computer Science and Engineering) |
| **Class, Semester** | Third Year B. Tech., Sem V |
| **Course Code** | |
| **Course Name** | Artificial Intelligence and Machine Learning |
| **Desired Requisites:** | |

| **Teaching Scheme** | | **Examination Scheme (Marks)** | | | |
|---|---|---|---|---|---|
| **Lecture** | 3 Hrs/week | **T1** | **T2** | **ESE** | **Total** |
| **Tutorial** | - | 20 | 20 | 60 | 100 |
| **Practical** | - | | | | |
| **Interaction** | - | **Credits: 3** | | | |

| **Course Objectives** | |
|---|---|
| **1** | To acquaint students with the meaning, purpose, scope, stages, applications, and effects of AI |
| **2** | To share the basic tasks and algorithms in Machine Learning |
| **3** | To provide understanding of how system learns in supervised learning |
| **4** | |

| **Course Outcomes (CO) with Bloom's Taxonomy Level** | | |
|---|---|---|
| At the end of the course, the students will be able to, | | |
| **CO1** | explain fundamental concepts and challenges in AI and ML | Understanding |
| **CO2** | create representations of the domain of interest and reason with these representations | Applying |
| **CO3** | apply search methods that agents can employ for problem solving. | Applying, Analyzing |
| **CO4** | apply machine learning algorithms to solve real life problems and compare the results | Applying, Analyzing |
| | | |

| **Module** | **Module Contents** | **Hours** |
|---|---|---|
| I | **Introduction**<br>Introduction, Intelligent agents, Search Strategies- State space search, Heuristic Search, Backtracking, Finding Optimal Paths: Branch & Bound, A*, Admissibility of A*. | 7 |
| II | **Game Playing**<br>Game Theory, Board Games and Game Trees, Algorithm Minimax, AlphaBeta and SSS*, Automated Planning: Domain Independent Planning, Blocks World, Forward & Backward Search, Goal Stack Planning, Plan Space Planning | 7 |
| III | **Knowledge Representation & Reasoning**<br>Introduction to Formal Logics, Propositional Logic, Syntax, Semantics, Forward Chaining, Programming in a Rule Based language. | 6 |
| IV | **Supervised Learning**<br>Machine Learning Paradigms, Predictive Modelling- Classification & Regression, Classification types, Classification Algorithms- Decision Trees, Naïve Bayes, Support Vector Machine, Neural Networks, Performance metrics, Handling Imbalanced Datasets. | 7 |
| V | **Regression**<br>Linear Regression with One Variable, Gradient Descent, Gradient Descent for Multiple Variables, Polynomial Regression, Normal Equation Non-invertibility, Logistic Regression, Impact of scaling, learning rate and regularization, Performance measures. | 6 |

| | | |
|---|---|---|
| VI | **Unsupervised Learning**<br>Unsupervised Learning: Introduction, K-Means Algorithm, Optimization Objective, Random Initialization, Choosing the Number of Clusters, KNN Clustering Algorithm, Dimensionality Reduction with PCA. | 6 |

| **Text Books** | |
|---|---|
| 1 | Bell J., "*Machine Learning Hands-On for Developers and Technical Professionals*", Wiley 2015 |
| 2 | Mitchell T. M., "Machine Learning", MGH |
| 3 | Marsland S., "*Machine Learning: An Algorithmic Perspective*", Chapman & Hall/CRC, 2nd edition 2014. |
| 4 | Khemani D., "*A First Course in Artificial Intelligence*", McGraw Hill Education (India), 2013. |

| **References** | |
|---|---|
| 1 | Khemani D., "*Artificial Intelligence: Knowledge Representation and Reasoning*", IIT Madras, Lecture Notes. |
| 2 | |
| 3 | |
| 4 | |

| **Useful Links** | |
|---|---|
| 1 | Artificial Intelligence: Knowledge Representation and Reasoning Course on NPTEL: Link |
| 2 | Introduction to Machine Learning Course on NPTEL: Link |
| 3 | Machine Learning Course on CourseEra: Link |
| 4 | Artificial Intelligence Search Methods for Problem Solving Course on NPTEL: Link |

**CO-PO Mapping**

| | **Programme Outcomes (PO)** | | | | | | | | | | | | **PSO** | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 |
| **CO1** | 2 | | | | | | | | | | | | 1 | | |
| **CO2** | | 2 | | | | | | | | | | | | 2 | |
| **CO3** | | | | 2 | | | | | | | | | 2 | | |

The strength of mapping is to be written as 1,2,3; Here, 1: Low, 2: Medium, 3: High
Each CO of the course must map to at least one PO.

**Assessment**

The assessment is based on 2 in-semester examinations in the form of T1 (Test-1) and T2 (Test-2) of 20 marks each. Also, there shall be 1 End-Sem examination (ESE) of 60 marks. T1 shall be typically on modules 1 and 2, T2 based typically on modules 3, 4 and ESE shall be on all modules with nearly 50% weightage on modules 1 to 4 and 50% weightage on modules 5, 6.

**Assessment Plan based on Bloom's Taxonomy Level (Marks) For Theory Course**

| **Bloom's Taxonomy Level** | | **T1** | **T2** | **ESE** | **Total** |
|---|---|---|---|---|---|
| 1 | Remember | | | | |
| 2 | Understand | 10 | 5 | 15 | **30** |
| 3 | Apply | 5 | 10 | 30 | **45** |
| 4 | Analyze | 5 | 5 | 15 | **25** |
| 5 | Evaluate | | | | |
| 6 | Create | | | | |
| **Total** | | **20** | **20** | **60** | **100** |

# Walchand College of Engineering, Sangli

*(Government Aided Autonomous Institute)*

**AY 2021-22**

| Course Information | |
|---|---|
| **Programme** | B.Tech. (Computer Science and Engineering) |
| **Class, Semester** | Third Year B. Tech., Sem V |
| **Course Code** | |
| **Course Name** | Internet (Web) of Things |
| **Desired Requisites:** | Basic programming knowledge. |

| Teaching Scheme | | Examination Scheme (Marks) | | | |
|---|---|---|---|---|---|
| **Lecture** | 3 Hrs/week | **Test1** | **Test2** | **ESE** | **Total** |
| **Tutorial** | - | 20 | 20 | 60 | 100 |
| **Practical** | - | | | | |
| **Interaction** | - | **Credits: 3** | | | |

| Course Objectives | |
|---|---|
| **1** | To illustrate the basic concepts of Internet of Things. |
| **2** | To demonstrate working of Ardino and Raspberry pi. |
| **3** | To develop the skill of providing solution for real life problem using IOT. |
| **4** | |

| Course Outcomes (CO) with Bloom's Taxonomy Level | | |
|---|---|---|
| **CO1** | Explain how to design and develop Applications in IOT. | Apply |
| **CO2** | To Illustrate how IOT devices works | Apply |
| **CO3** | To access different operations using IOT applications. | Evaluate |
| **CO4** | To produce a program to solve a real-world problem. | Create |

| Module | Module Contents | Hours |
|---|---|---|
| I | **Introduction to Internet of Things**<br>Introduction, Physical design of IOT, Logical Design of IOT,IOT Enabling Technology. | 7 |
| II | **IOT and Communication Protocols**<br>Basics of Networking, Communication Protocols, Sensor Networks, Machine-to-Machine Communications | 6 |
| III | **Interoperability in IoT**<br>Introduction to Arduino Programming, Introduction to Python programming, Introduction to Raspberry Pi, Implementation of IoT with Raspberry Pi. | 6 |
| IV | **Data Analytics for IOT**<br>Apache Hadoop, Apache Oozie, Apache Spark, Using Apache Storm for real time Data analysis. | 6 |
| V | **Industrial IoT**<br>Introduction to IIOT,AWS-IOT, Introduction to Lora-wan, Node MCU IOT Platform. | 7 |
| VI | **Domain Specific IOT Case Studies**<br>Home Automation, Smart Cities, Environment, Energy, Retail, Logistic, Agriculture, Industry, Health and Lifestyle. | 7 |

| Text Books | |
|---|---|
| 1 | S. Misra, A. Mukherjee, and A. Roy, 2020. Introduction to IoT. Cambridge University Press. |
| 2 | S. Misra, C. Roy, and A. Mukherjee, 2020. Introduction to Industrial Internet of Things and Industry 4.0. CRC Press. |
| 3 | Research Papers |
| 4 | |

| References | |
|---|---|
| 1 | Arashdeep Bahga ,Vijay Madisetti Internet of Things an Hands on Approach,University Press. |
| 2 | |

| | |
|---|---|
| 3 | |
| 4 | |

| Useful Links | |
|---|---|
| 1 | https://onlinecourses.nptel.ac.in/noc21_cs17 |
| 2 | |
| 3 | |
| 4 | |

| CO-PO Mapping | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Programme Outcomes (PO)** | | | | | | | | | | | | **PSO** | | |
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 |
| **CO1** | | 3 | 3 | | | | | | | | | | 2 | | |
| **CO2** | 1 | | 2 | | | | | | | | | | 2 | | |
| **CO3** | 3 | 3 | 2 | | | | | | | | | | 2 | | |
| **CO4** | | 2 | 1 | | | | | | | | | | 2 | | |

The strength of mapping is to be written as 1,2,3; Where, 1:Low, 2:Medium, 3:High
Each CO of the course must map to at least one PO.

**Assessment (for Theory Course)**

The assessment is based on 2 in-semester examinations in the form of T1 (Test-1) and T2 (Test-2) of 20 marks each. Also there shall be 1 End-Sem examination (ESE) of 60 marks. T1 shall be typically on modules 1 and 2, T2 based typically on modules 3, 4 and ESE shall be on all modules with nearly 50% weightage on modules 1 to 4 and 50% weightage on modules 5, 6.

Assessment Plan based on Bloom's Taxonomy Level (Marks) For Theory Course

| **Bloom's Taxonomy Level** | | **T1** | **T2** | **ESE** | **Total** |
|---|---|---|---|---|---|
| 1 | Remember | | 5 | 5 | 10 |
| 2 | Understand | 5 | 5 | 10 | 20 |
| 3 | Apply | 5 | | 10 | 15 |
| 4 | Analyze | 10 | 5 | 15 | 30 |
| 5 | Evaluate | | 5 | 10 | 15 |
| 6 | Create | | | 10 | 10 |
| **Total** | | **20** | **20** | **60** | **100** |

# Walchand College of Engineering, Sangli

*(Government Aided Autonomous Institute)*

**AY 2021-22**

| **Course Information** | |
|---|---|
| **Programme** | B.Tech. (Computer Science and Engineering) |
| **Class, Semester** | Third Year B. Tech., Sem V |
| **Course Code** | |
| **Course Name** | Computer Graphics |
| **Desired Requisites:** | C/C++ Programming, Data Structures & Files, Java Programming |

| **Teaching Scheme** | | **Examination Scheme (Marks)** | | | |
|---|---|---|---|---|---|
| **Lecture** | 3 Hrs/week | **T1** | **T2** | **ESE** | **Total** |
| **Tutorial** | - | 20 | 20 | 60 | 100 |
| **Practical** | - | | | | |
| **Interaction** | - | **Credits: 3** | | | |

| **Course Objectives** | |
|---|---|
| **1** | To introduce the use of the components of a graphics system and become familiar with building approach of graphics system components and algorithms related with them. |
| **2** | To learn the basic principles of 3- dimensional computer graphics |
| **3** | Provide an understanding of how to scan convert the basic geometrical primitives, how to transform the shapes to fit them as per the picture definition. |
| **4** | Provide an understanding of mapping from a world coordinates to device coordinates, clipping, and projections. |
| **5** | To be able to discuss the application of computer graphics concepts in the development of<br>computer games, information visualization, and business applications |
| **6** | To comprehend and analyze the fundamentals of animation, virtual reality, underlying technologies, principles, and applications. |

**Course Outcomes (CO) with Bloom's Taxonomy Level**

At the end of the course, the students will be able to,

| | | |
|---|---|---|
| **CO1** | Perceive the fundamental concepts of Computer Graphics | Understanding |
| **CO2** | Handle different transformation algorithms. | Applying |
| **CO3** | Execute 2D Clipping Algorithms | Applying |
| **CO4** | Appraise acquired transformations with projection using modern tools | Analyzing |
| **CO5** | Rehash technique of computer animation and its relationship with image and storage | Analyzing |

| **Module** | **Module Contents** | **Hours** |
|---|---|---|

| | | |
|---|---|---|
| I | **Introduction to computer Graphics**<br>Definition, Input and output Devices,<br>**Introduction to graphics primitives** such as points, lines, polygons, etc.; representation of pictures using primitives; storage & retrieval of pictures;<br>**Rasterization techniques:** Line – DDA; Bradenham's generalized integer version; Mid-point rasterization. Circle – Bradenham's algorithm; Mid-Point algorithm 1st order difference & 2nd order difference methods | 4 |
| II | **2D and 3D introduction**<br>**2D Scan conversion & polygon filling**: Active-Edge-List (y-bucket) scan conversion of lines & polygons; Edge –fill , simple Seed –fill & Scan –line seed –fill algorithms.<br>**2D Geometric transformations**: Introduction to representation of 2D objects as matrices; transformation matrices for scaling, shear, rotation, reflection<br>**3D Geometric transformations:** Introduction to representation of 3 D objects as matrices; transformation matrices for scaling, shear, rotation, reflection | 5 |
| III | **2D Clipping**<br>Clipping against regular window – Explicit line clipping; Sutherland & Cohen line clipping, Mid-point subdivision line clipping; Sutherland & Hodgemann polygon clipping | 4 |
| IV | **Projection**<br>Introducing the idea of projecting 3D object on to 2D plane; broad classification – parallel & perspective projection; different types of parallel projection & examples of each; formal definition of 3D to 2D projection and derivation of projection matrix; 1-point, 2-point & 3-point perspective projection; formal derivation of vanishing point(s) and physical implication of the same. | 4 |
| V | **Computer Animation**<br>Introduction, Key frame animation, Construction of an animation sequence, Motion control methods, Procedural animation, Key-frame animation vs. Procedural animation, Introduction to Morphing, Wraping techniques, Three dimensional morphing. | 5 |
| VI | **Image Manipulation and Storage**<br>What is an Image? Digital image file formats, Image compression standard – JPEG, Image Processing - Digital image enhancement, contrast stretching, Histogram Equalization, smoothing and median Filtering | 4 |

| | |
|---|---|
| | **Text Books** |
| 1 | "Mathematical Elements for Computer Graphics", David F. Rogers, J Alan, Adams, TMGH, 2nd Edition |
| 2 | "Procedural Elements for Computer Graphics", David F. Rogers, TMGH, 2nd Edition |
| 3 | "Interactive Comp. Graphics, A Top-Down Approach using OpenGL", Edward Angel, Pearson, 5th Edition |
| | **References** |
| 1 | Procedural Elements for Computer Graphics by David F.Rogers, TMH publication |
| 2 | Mathematical Elements for Computer Graphics by David F. Rogers and J. A. Adams, TMH Publication |
| 3 | Computer Graphics, principles & practices by J.D. Foley, A. van Dam, S.K. Feiner and J.F. Huges, Addison Wesley |
| 4 | Computer Graphics, C version, by D. Hearn and M.P. Baker, Pearson Education. |
| 5 | Computer Graphics, a programming approach, by S. Harrington, TMH publication |
| **6** | Computer Graphics by A.N. Sinha and A.D. Udai, TMH publication |
| | **Useful Links** |

| | |
|---|---|
| 1 | https://www.geeksforgeeks.org/ |
| 2 | https://nptel.ac.in/courses/106/106/106106090/ |

| CO-PO Mapping | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Programme Outcomes (PO) | | | | | | | | | | | | PSO | | |
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 |
| **CO1** | 2 | 2 | | | | | | | | | | | 1 | | |
| **CO2** | 3 | 2 | 2 | | | | | | | | | | 1 | | |
| **CO3** | 2 | 2 | 3 | | | | | | | | | | | | |
| **CO4** | 1 | 2 | 2 | | 3 | | | | | | | | | | |
| **CO5** | 1 | 2 | 1 | | | | | | | | | | | | |
| The strength of mapping is to be written as 1,2,3; Where, 1:Low, 2:Medium, 3:High<br>Each CO of the course must map to at least one PO. | | | | | | | | | | | | | | | |

| **Assessment (for Theory Course)** |
|---|
| The assessment is based on 2 in-semester examinations in the form of T1 (Test-1) and T2 (Test-2) of 20 marks each. Also there shall be 1 End-Sem examination (ESE) of 60 marks. T1 shall be typically on modules 1 and 2, T2 based typically on modules 3, 4 and ESE shall be on all modules with nearly 50% weightage on modules 1 to 4 and 50% weightage on modules 5, 6. |

| **Assessment Plan based on Bloom's Taxonomy Level (Marks) For Theory Course** | | | | | |
|---|---|---|---|---|---|
| **Bloom's Taxonomy Level** | | **T1** | **T2** | **ESE** | **Total** |
| 1 | Remember | | | | |
| 2 | Understand | 5 | | 5 | 10 |
| 3 | Apply | 10 | 10 | 25 | 45 |
| 4 | Analyze | 5 | 10 | 30 | 45 |
| 5 | Evaluate | | | | |
| 6 | Create | | | | |
| **Total** | | **20** | **20** | **60** | **100** |

## Walchand College of Engineering, Sangli

*(Government Aided Autonomous Institute)*

**AY 2021-22**

**Course Information**

| | |
|---|---|
| **Programme** | B.Tech. (Computer Science and Engineering) |
| **Class, Semester** | Third Year B. Tech., Sem V |
| **Course Code** | |
| **Course Name** | Image Processing Lab |
| **Desired Requisites:** | |

| **Teaching Scheme (Hrs)** | | **Examination Scheme (Marks)** | | | |
|---|---|---|---|---|---|
| **Lecture** | - | **LA1** | **LA2** | **ESE** | **Total** |
| **Tutorial** | - | 30 | 30 | 40 | 100 |
| **Practical** | 2 | | | | |
| **Interaction** | - | **Credits: 1** | | | |

**Course Objectives**

| | |
|---|---|
| **1** | To share in-depth knowledge of the course |
| **2** | To deliver hand-on experience in the field |
| **3** | To inculcate interest in different domain areas |

**Course Outcomes (CO) with Bloom's Taxonomy Level**

At the end of the course, the students will be able to,

| | | |
|---|---|---|
| **CO1** | Demonstrate various techniques of image processing related to theoretical knowledge gained. | Applying |
| **CO2** | To analyse and compare the results of various algorithms | Analysing |

**List of Experiments / Lab Activities**

**List of Experiments:**

Lab sessions are to be utilized for problem solving/designing/implementation, to ensure that students have properly learnt the topics covered in the theory course. From below at least 10-12 assignments should be taken

1. Implement and apply different types of image transforms : scaling, rotation, transformation
2. Applying and analysing result of different image processing techniques: thresholding, contrast stretching.
3. Application of histogram equivalization technique
4. Implement image enhancement technique: Unsharp masking
5. Implement image enhancement technique: High boost filtering
6. Apply Different edge detection techniques: ( canny, image subtraction etc)
7. Implement and / or apply different image segmentation techniques and analyse them
8. Implement different morphological image operations
9. Apply different image compression techniques

**Text Books**

| | |
|---|---|
| 1 | R. C. Gonzalez, R. E. Woods, Digital Image Processing, 4th Edition. 2018, PHI |
| 2 | A. K. Jain, Fundamentals of Digital Image Processing, PHI |

**References**

| | |
|---|---|
| 1 | Milan Sonka, Vaclav Hlavac, Boyle, Digital Image Processing and Computer Vision, Cengage Learning |
| 2 | S. Jayaraman, S. Esakkirajan, T. Veerkumar, Digital Image Processing, Tata McGrawHill |
| 3 | Rafael C. Gonzalez, Richard E. Woods, Steven L. Eddins, Digital Image Processing Using |

| | |
|---|---|
| | MATLAB, 2nd ed. |
| | |
| **Useful Links** | |
| 1 | NPTEL course: Link |
| 2 | NPTEL course: Link |

| **CO-PO Mapping** | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Programme Outcomes (PO)** | | | | | | | | | | | **PSO** | | |
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| **CO1** | 1 | | | 2 | | | | | | | | | 1 | |
| **CO2** | | | | | 3 | | | | | | | | | |

The strength of mapping is to be written as 1,2,3; Where, 1:Low, 2:Medium, 3:High
Each CO of the course must map to at least one PO.

**Assessment**

There are three components of lab assessment, LA1, LA2 and Lab ESE.
IMP: Lab ESE is a separate head of passing. LA1, LA2 together is treated as In-Semester Evaluation.

| **Assessment** | **Based on** | **Conducted by** | **Typical Schedule (for 26-week Sem)** | **Marks** |
|---|---|---|---|---|
| LA1 | Lab activities, attendance, journal | Lab Course Faculty | During Week 1 to Week 6<br>Marks Submission at the end of Week 6 | 30 |
| LA2 | Lab activities, attendance, journal | Lab Course Faculty | During Week 7 to Week 12<br>Marks Submission at the end of Week 12 | 30 |
| Lab ESE | Lab activities, attendance, journal | Lab Course Faculty | During Week 15 to Week 18<br>Marks Submission at the end of Week 18 | 40 |

Week 1 indicates the starting week of a semester. The typical schedule of lab assessments is shown, considering a 26-week semester. The actual schedule shall be as per academic calendar. Lab activities/Lab performance shall include performing experiments, mini-project, presentations, drawings, programming and other suitable activities, as per the nature and requirement of the lab course. The experimental lab shall have typically 8-10 experiments.

**Assessment Plan based on Bloom's Taxonomy Level (Marks) (For lab Courses)**

| **Bloom's Taxonomy Level** | **LA1** | **LA2** | **ESE** | **Total** |
|---|---|---|---|---|
| Remember | | | | |
| Understand | | | | |
| Apply | 20 | 20 | 25 | |
| Analyze | 10 | 10 | 15 | |
| Evaluate | | | | |
| Create | | | | |
| **Total Marks** | **30** | **30** | **40** | **100** |

# Walchand College of Engineering, Sangli

*(Government Aided Autonomous Institute)*

**AY 2021-22**

**Course Information**

| | |
|---|---|
| **Programme** | B.Tech. (Computer Science & Engineering) |
| **Class, Semester** | Third Year B. Tech., Sem V |
| **Course Code** | |
| **Course Name** | Artificial Intelligence and Machine Learning Lab |
| **Desired Requisites:** | Knowledge of Statistics and Probability |

| **Teaching Scheme** | | **Examination Scheme (Marks)** | | | |
|---|---|---|---|---|---|
| **Lecture** | - | **LA1** | **LA2** | **ESE** | **Total** |
| **Tutorial** | - | 30 | 30 | 40 | 100 |
| **Practical** | 2 Hrs/Week | | | | |
| **Interaction** | - | **Credits: 1** | | | |

**Course Objectives**

| | |
|---|---|
| **1** | To make students do practical implementation of the different AI and ML concepts and techniques. |
| **2** | To make students familiar with steps involved in applying machine learning algorithms to real-life problems |
| **3** | To get insights of how pure AI algorithms can be used |
| **4** | To develop research interest towards this field |

**Course Outcomes (CO) with Bloom's Taxonomy Level**

At the end of the course, the students will be able to,

| | | |
|---|---|---|
| **CO1** | **apply** AI and ML algorithms to **solve** real world problems and **analyze** the results. | Apply, Analyze |
| **CO2** | **Design** and **provide** best solution to AI and ML problems by **measuring** the performance of different algorithms/tools, and **comparing** them. | Evaluate, Create |

**List of Experiments / Lab Activities**

**List of Experiments:**

1. Represent knowledge in different forms
   a) Logical Representation.
   b) Semantic Networks
   c) Production Rules
   d) Frame Representation.

2. Apply Branch-and-bound technique to Travelling Salesman Problem

3. Apply Backtracking to Sudoku/ N-Queen/ Subset sum problem.

4. Use Minimax approach to find optimal move in a Tic-Tac-Toe Game.

5. Design and implementation of Naïve Bayes Algorithm to find the probability of playing a Golf or not playing it, under given environmental conditions.

6. Adopt procedures to handle imbalanced datasets and compare performance.

7. Perform regression on given House Prices dataset considering one variable (Area) and multiple variables.

8. Implement K-means and KNN Clustering algorithm to given dataset by varying the number of clusters and compare the results.

Mini-project: Group (2/3) students may select topic from research journal/ literature as a problem statement. Design and build the AI system for that problem. OR The problem statement may be assigned group-wise.

| Text Books | |
|---|---|
| 1 | Bell J., “*Machine Learning Hands-On for Developers and Technical Professionals*”, Wiley 2015 |
| 2 | Mitchell T. M., “Machine Learning”, MGH |
| 3 | Marsland S., “*Machine Learning: An Algorithmic Perspective*”, Chapman & Hall/CRC, 2nd edition 2014. |
| 4 | Khemani D., “*A First Course in Artificial Intelligence*”, McGraw Hill Education (India), 2013. |

| References | |
|---|---|
| 1 | Khemani D., “*Artificial Intelligence: Knowledge Representation and Reasoning*”, IIT Madras, Lecture Notes. |

| Useful Links | |
|---|---|
| 1 | Artificial Intelligence: Knowledge Representation and Reasoning Course on NPTEL: Link |
| 2 | Introduction to Machine Learning Course on NPTEL: Link |
| 3 | Machine Learning Course on CourseEra: Link |
| 4 | Artificial Intelligence Search Methods for Problem Solving Course on NPTEL: Link |

**CO-PO Mapping**

| | Programme Outcomes (PO) | | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 |
| **CO1** | 3 | 2 | | | | | | | | | | | 2 | | |
| **CO2** | | | 2 | | 2 | | | | | | | | | 3 | |

The strength of mapping is to be written as 1,2,3; Here, 1: Low, 2: Medium, 3: High
Each CO of the course must map to at least one PO.

**Assessment**

There are three components of lab assessment, LA1, LA2 and Lab ESE.
IMP: Lab ESE is a separate head of passing. LA1, LA2 together is treated as In-Semester Evaluation.

| Assessment | Based on | Conducted by | Typical Schedule | Marks |
|---|---|---|---|---|
| LA1 | Lab activities, attendance, journal | Lab Course Faculty | During Week 1 to Week 6<br>Marks Submission at the end of Week 6 | 30 |
| LA2 | Lab activities, attendance, journal | Lab Course Faculty | During Week 7 to Week 12<br>Marks Submission at the end of Week 12 | 30 |
| ESE | Lab activities, attendance, journal | Lab Course Faculty | During Week 15 to Week 18<br>Marks Submission at the end of Week 18 | 40 |

Week 1 indicates starting week of a semester. The typical schedule of lab assessments is shown, considering a 26-week semester. The actual schedule shall be as per academic calendar. Lab activities/Lab performance shall include performing experiments, mini-project, presentations, drawings, programming and other suitable activities, as per the nature and requirement of the lab course. The experimental lab shall have typically 8-10 experiments.

**Assessment Plan based on Bloom’s Taxonomy Level (Marks)**

| Bloom’s Taxonomy Level | LA1 | LA2 | ESE | Total |
|---|---|---|---|---|
| Remember | | | | |
| Understand | | | | |
| Apply | 15 | 15 | 15 | 45 |
| Analyze | 5 | 5 | 5 | 15 |
| Evaluate | 10 | 10 | 10 | 30 |
| Create | | | 10 | 10 |
| **Total** | **30** | **30** | **40** | **100** |

# Walchand College of Engineering, Sangli

*(Government Aided Autonomous Institute)*

**AY 2021-22**

**Course Information**

| | |
|---|---|
| **Programme** | B.Tech. (Computer Science and Engineering) |
| **Class, Semester** | Third Year B. Tech., Sem V |
| **Course Code** | |
| **Course Name** | Internet (Web) of Things Lab |
| **Desired Requisites:** | Nil |

| **Teaching Scheme (Hrs)** | | **Examination Scheme (Marks)** | | | |
|---|---|---|---|---|---|
| **Lecture** | - | **LA1** | **LA2** | **ESE** | **Total** |
| **Tutorial** | - | 30 | 30 | 40 | 100 |
| **Practical** | 2 | | | | |
| **Interaction** | - | **Credits: 1** | | | |

**Course Objectives**

| | |
|---|---|
| **1** | To share in-depth knowledge of the course |
| **2** | To deliver hand-on experience in the field |
| **3** | To inculcate interest in different domain areas |
| **4** | |

**Course Outcomes (CO) with Bloom's Taxonomy Level**

| | | |
|---|---|---|
| **CO1** | To apply the knowledge gained for solving different problems. | Apply |
| **CO2** | To Demonstrate basics of IOT | Apply |
| **CO3** | To analyse and evaluate the solutions and compare them. | Evaluate |
| **CO4** | To create and implement mini project to solve real life problems. | Create |

**List of Experiments / Lab Activities**

**List of Experiments:**

Experiment1 : Arduino basics and Introduction to python programming.
Experiment 2 : Study of Raspberry pi.
Experiment 3 : Implementation of IOT with Raspberry pi.
Experiment 4 : Blink an LED with an Arduino in Tinkercad.
Experiment 5: Smart gate system using Tinkercad.
Experiment 6: Traffic light system using Tinkercad.
Experiment 7: Study of IOT cloud platforms such as ThingSpeak AWS IOT core, Microsoft Azure IOT Hub, Cisco IOT cloud connect etc.
Experiment 8: Study Amazon web services-IOT
Experiment 9: Implementation of Amazon S3,Amazon Dynamo DB,AWS Lambda, Amazon SNS.
Experiment 10: Study of Node MCU IOT platform.
Experiment 11: Introduction to Lora-Wan.
Experiment 12: Any Mini project implementation using concepts of IOT.

**Text Books**

| | |
|---|---|
| 1 | Mandler B., Barja J., Campista Mitre, M.E., Cagá_ová, D. Chaouchi, H. Zeadally, S. Badra, M. Giordano, S. Fazio, M. Somov, A. Vieriu, R.-L., "Internet of Things. IoT Infrastructures" , Springer International Publishing, Second International Summit, IoT 360° 2015, Rome, Italy, October 27-29, 2015. Revised Selected Papers, Part I |
| 2 | Kyung, C.-M., Yasuura, H. Liu, Y. Lin, Y.-L., "Smart Sensors and Systems", Springer International Publishing,2017. |

| References | |
|---|---|
| 1 | Hersent Olivier, Boswarthick David , Elloumi Omar , “The Internet of Things: Key Applications and Protocols”, Wiley-Blackwell, Second Edition ,2012 |
| 2 | S. Misra, A. Mukherjee, and A. Roy, 2020. *Introduction to IoT*. Cambridge University Press. |
| 3 | S. Misra, C. Roy, and A. Mukherjee, 2020. *Introduction to Industrial Internet of Things and Industry 4.0.* CRC Press. |

| Useful Links | |
|---|---|
| 1 | https://onlinecourses.nptel.ac.in/noc21_cs17/preview |
| 2 | https://www.tinkercad.com/things/55ubLwvGK0g-1st-iot-project |

| CO-PO Mapping | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Programme Outcomes (PO) | | | | | | | | | | | | PSO | | |
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 |
| **CO1** | | | | | 1 | 1 | | | | | 2 | | 3 | | |
| **CO2** | | | | | 1 | 1 | | | | | 2 | | 3 | | |
| **CO3** | | | | | 1 | 1 | | | | | 2 | | 3 | | |
| **CO4** | | | | | 1 | 1 | | | | | 2 | | 3 | | |

The strength of mapping is to be written as 1,2,3; Where, 1:Low, 2:Medium, 3:High
Each CO of the course must map to at least one PO.

**Assessment**

There are three components of lab assessment, LA1, LA2 and Lab ESE.
IMP: Lab ESE is a separate head of passing. LA1, LA2 together is treated as In-Semester Evaluation.

| Assessment | Based on | Conducted by | Typical Schedule (for 26-week Sem) | Marks |
|---|---|---|---|---|
| LA1 | Lab activities, attendance, journal | Lab Course Faculty | During Week 1 to Week 6<br>Marks Submission at the end of Week 6 | 30 |
| LA2 | Lab activities, attendance, journal | Lab Course Faculty | During Week 7 to Week 12<br>Marks Submission at the end of Week 12 | 30 |
| Lab ESE | Lab activities, attendance, journal | Lab Course Faculty | During Week 15 to Week 18<br>Marks Submission at the end of Week 18 | 40 |

Week 1 indicates starting week of a semester. The typical schedule of lab assessments is shown, considering a 26-week semester. The actual schedule shall be as per academic calendar. Lab activities/Lab performance shall include performing experiments, mini-project, presentations, drawings, programming and other suitable activities, as per the nature and requirement of the lab course. The experimental lab shall have typically 8-10 experiments.

**Assessment Plan based on Bloom’s Taxonomy Level (Marks) (For lab Courses)**

| Bloom’s Taxonomy Level | LA1 | LA2 | Lab ESE | Total |
|---|---|---|---|---|
| Remember | 5 | | 5 | **10** |
| Understand | 5 | | 5 | **10** |
| Apply | 5 | | 10 | **15** |
| Analyze | 5 | 10 | 5 | **20** |
| Evaluate | 10 | | 5 | **15** |
| Create | | 20 | 10 | **30** |
| **Total Marks** | **30** | **30** | **40** | **100** |

# Walchand College of Engineering, Sangli

*(Government Aided Autonomous Institute)*

**AY 2021-22**

| **Course Information** | |
|---|---|
| **Programme** | B.Tech. (Computer Science and Engineering) |
| **Class, Semester** | Third Year B. Tech., SemV |
| **Course Code** | |
| **Course Name** | Computer Graphics Lab |
| **Desired Requisites:** | C/C++ Programming, Data Structures & Files, Java Programming |

| **Teaching Scheme (Hrs)** | | **Examination Scheme (Marks)** | | | |
|---|---|---|---|---|---|
| **Lecture** | - | **LA1** | **LA2** | **ESE** | **Total** |
| **Tutorial** | - | 30 | 30 | 40 | 100 |
| **Practical** | 2 | | | | |
| **Interaction** | - | **Credits: 1** | | | |

| **Course Objectives** | |
|---|---|
| **1** | To introduce the use of the components of a graphics system and become familiar with building approach of graphics system components and algorithms related with them. |
| **2** | To learn the basic principles of 3- dimensional computer graphics. |
| **3** | Provide an understanding of how to scan convert the basic geometrical primitives, how to transform the shapes to fit them as per the picture definition. |
| **4** | Provide an understanding of mapping from a world coordinates to device coordinates, clipping, and projections. |
| **5** | To be able to discuss the application of computer graphics concepts in the development of computer games, information visualization, and business applications |
| **6** | To comprehend and analyze the fundamentals of animation, virtual reality, underlying technologies, principles, and applications |

**Course Outcomes (CO) with Bloom's Taxonomy Level**

At the end of the course, the students will be able to,

| | | |
|---|---|---|
| **CO1** | Outline the fundamental concepts of Computer Graphics | Understanding |
| **CO2** | Illustrate the fundamental concepts of computer graphics with its different transformations using algorithms | Applying |
| **CO3** | Solve different algorithms on 2D clipping | Applying |
| **CO4** | Investigate acquired transformations with projection. | Analyzing |
| **CO5** | Scrutinize technique of computer animation and figure out relation with image and storage. | Analyzing |

**List of Experiments / Lab Activities**

**List of Experiments:**

Minimum 8 experiments will be performed to understand functioning of Computer graphics & its visualization. The list contains:

1. Practical based on C/C++ graphics library.
2. Introductory OpenGL programming.
3. Visualization of Data Sets.
4. 2D Transformations.
5. 3D Transformations and animation.
6. Line/Circle generation algorithm.
7. Polygon filling algorithms.
8. Hidden line/surface elimination algorithms (Z Buffer)
9. Curve Generation (Cubic spline, Bezier).
10. Study of Multimedia-file formats. (BMP-JPG/WAV-MP3/DAT-MPG etc).
11. Visualization applications / Case tools/ animation using Multimedia concepts

| **Text Books** | |
|---|---|
| 1 | "Mathematical Elements for Computer Graphics", David F. Rogers, J Alan, Adams, TMGH, 2$^{nd}$ Edition |

| | |
|---|---|
| 2 | "Procedural Elements for Computer Graphics", David F. Rogers, TMGH, 2nd Edition |
| 3 | "Interactive Comp. Graphics, A Top-Down Approach using OpenGL", Edward Angel, Pearson, 5th Edition |

| **References** | |
|---|---|
| 1 | Procedural Elements for Computer Graphics by David F.Rogers, TMH publication. |
| 2 | Mathematical Elements for Computer Graphics by David F. Rogers and J. A. Adams, TMH Publication |
| 3 | Computer Graphics, principles & practices by J.D. Foley, A. van Dam, S.K. Feiner and J.F. Huges, Addison Wesley |
| 4 | Computer Graphics, C version, by D. Hearn and M.P. Baker, Pearson Education |
| 5 | Computer Graphics, a programming approach, by S. Harrington, TMH publication |
| 6 | Computer Graphics by A.N. Sinha and A.D. Udai, TMH publication |

| **Useful Links** | |
|---|---|
| 1 | https://www.geeksforgeeks.org/ |
| 2 | https://nptel.ac.in/courses/106/106/106106090/ |

**CO-PO Mapping**

| | **Programme Outcomes (PO)** | | | | | | | | | | | | **PSO** | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 |
| **CO1** | 2 | 2 | 1 | | | | | | | | | | | | |
| **CO2** | 3 | 2 | 1 | 2 | | | | | | | | | | | |
| **CO3** | | 2 | 1 | | 2 | | | | | | | | 3 | | |
| **CO4** | 1 | 2 | 1 | 2 | 3 | | | | | | | 2 | | | |
| **CO5** | 1 | 2 | 1 | | 3 | | | | | | | | | | |

The strength of mapping is to be written as 1,2,3; Where, 1:Low, 2:Medium, 3:High
Each CO of the course must map to at least one PO.

**Assessment**

There are three components of lab assessment, LA1, LA2 and Lab ESE.
IMP: Lab ESE is a separate head of passing. LA1, LA2 together is treated as In-Semester Evaluation.

| **Assessment** | **Based on** | **Conducted by** | **Typical Schedule (for 26-week Sem)** | **Marks** |
|---|---|---|---|---|
| LA1 | Lab activities, attendance, journal | Lab Course Faculty | During Week 1 to Week 6<br>Marks Submission at the end of Week 6 | 30 |
| LA2 | Lab activities, attendance, journal | Lab Course Faculty | During Week 7 to Week 12<br>Marks Submission at the end of Week 12 | 30 |
| Lab ESE | Lab activities, attendance, journal | Lab Course Faculty | During Week 15 to Week 18<br>Marks Submission at the end of Week 18 | 40 |

Week 1 indicates starting week of a semester. The typical schedule of lab assessments is shown, considering a 26-week semester. The actual schedule shall be as per academic calendar. Lab activities/Lab performance shall include performing experiments, mini-project, presentations, drawings, programming and other suitable activities, as per the nature and requirement of the lab course. The experimental lab shall have typically 8-10 experiments.

**Assessment Plan based on Bloom's Taxonomy Level (Marks) (For lab Courses)**

| **Bloom's Taxonomy Level** | **LA1** | **LA2** | **ESE** | **Total** |
|---|---|---|---|---|
| Remember | | | | |
| Understand | 5 | | 5 | **10** |
| Apply | 15 | 20 | 25 | **60** |
| Analyze | 10 | 10 | 10 | **30** |
| Evaluate | | | | |
| Create | | | | |
| **Total Marks** | **30** | **30** | **40** | **100** |

# Walchand College of Engineering, Sangli

*(Government Aided Autonomous Institute)*

**AY 2021-22**

| Course Information | |
|---|---|
| **Programme** | B.Tech. (Computer Science and Engineering) |
| **Class, Semester** | Third Year B. Tech., Sem V |
| **Course Code** | |
| **Course Name** | OE-1 Data Science using Python |
| **Desired Requisites:** | Nil |

| Teaching Scheme | | Examination Scheme (Marks) | | | |
|---|---|---|---|---|---|
| **Lecture** | 2 Hrs/week | **T1** | **T2** | **ESE** | **Total** |
| **Tutorial** | - | 20 | 20 | 60 | 100 |
| **Practical** | - | | | | |
| **Interaction** | - | **Credits: 2** | | | |

| Course Objectives | |
|---|---|
| **1** | Introduce python as a programming language |
| **2** | Introduce the mathematical foundations required for data science |
| **3** | Introduce the first level data science algorithms |
| **4** | Introduce a practical capstone case study |

| Course Outcomes (CO) with Bloom's Taxonomy Level | | |
|---|---|---|
| **CO1** | Explain a flow process for data science problems | Understand |
| **CO2** | Implement Python codes for data science solutions | Apply |
| **CO3** | Correlate results to the solution approach followed | Apply |
| **CO4** | Construct use cases to validate approach and identify modifications required | Analyze |

| Module | Module Contents | Hours |
|---|---|---|
| I | **Introduction and Programming in python**<br>Introduction, Tables, Building Tables | 4 |
| II | **Data Visualization**<br>Census, Charts, Histograms, Functions, Groups | 5 |
| III | **Introduction to Statistics**<br>Iteration, Chance, Sampling, Models, Comparing Distributions | 4 |
| IV | **Hypothesis Testing**<br>A/B Testing, Causality, Confidence Intervals, Interpreting Confidence, Center and Spread, The Normal Distribution | 5 |
| V | **Classification and Regression**<br>Classification, Classifiers, Correlation, Linear Regression | 4 |
| VI | **Classification and Regression Case Studies**<br>Residuals, Regression Inference, Case Study | 4 |

| Text Books | |
|---|---|
| 1 | Computational and Inferential Thinking, The Foundations of Data Science By Ani Adhikari and John DeNero UC Berkeley. (Available Online) |
| 2 | The Elements of Statistical Learning, Data Mining, Inference, and Prediction (2nd Edn.), Trevor Hastie Robert Tibshirani, Jerome Friedman, Springer, 2014 |
| 3 | |
| 4 | |

| References | |
|---|---|
| 1 | Probability & Statistics for Engineers & Scientists (9th Edn.), Ronald E. Walpole, Raymond H. Myers, Sharon L. Myers and Keying Ye, Prentice Hall Inc. |
| 2 | |
| 3 | |
| 4 | |

| | |
|---|---|
| **Useful Links** | |
| 1 | http://data8.org/ |
| 2 | |
| 3 | |
| 4 | |

| **CO-PO Mapping** | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Programme Outcomes (PO)** | | | | | | | | | | | | **PSO** | | |
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 |
| **CO1** | 2 | | | | | | | | | | | | | 2 | |
| **CO2** | | | | | 3 | | | | | | | | | | |
| **CO3** | | | 2 | | | | | | | | | 1 | | | |
| **CO4** | | | 3 | 3 | | | | | | | | | 3 | | |

The strength of mapping is to be written as 1,2,3; Where, 1:Low, 2:Medium, 3:High
Each CO of the course must map to at least one PO.

### Assessment (for Theory Course)

The assessment is based on 2 in-semester examinations in the form of T1 (Test-1) and T2 (Test-2) of 20 marks each. Also there shall be 1 End-Sem examination (ESE) of 60 marks. T1 shall be typically on modules 1 and 2, T2 based typically on modules 3, 4 and ESE shall be on all modules with nearly 50% weightage on modules 1 to 4 and 50% weightage on modules 5, 6.

### Assessment Plan based on Bloom's Taxonomy Level (Marks) For Theory Course

| **Bloom's Taxonomy Level** | | **T1** | **T2** | **ESE** | **Total** |
|---|---|---|---|---|---|
| 1 | Remember | | | | |
| 2 | Understand | 10 | 5 | 10 | 25 |
| 3 | Apply | 10 | 10 | 25 | 45 |
| 4 | Analyze | | 5 | 25 | 30 |
| 5 | Evaluate | | | | |
| 6 | Create | | | | |
| **Total** | | **20** | **20** | **60** | **100** |

# Walchand College of Engineering, Sangli

*(Government Aided Autonomous Institute)*

**AY 2021-22**

**Course Information**

| | |
|---|---|
| **Programme** | B.Tech. (Computer Science and Engineering) |
| **Class, Semester** | Third Year B. Tech., Sem V |
| **Course Code** | |
| **Course Name** | OE-2 Software Engineering and Database Essentials |
| **Desired Requisites:** | Nil |

| **Teaching Scheme** | | **Examination Scheme (Marks)** | | | |
|---|---|---|---|---|---|
| **Lecture** | 3 Hrs/week | **T1** | **T2** | **ESE** | **Total** |
| **Tutorial** | - | 20 | 20 | 60 | 100 |
| **Practical** | - | | | | |
| **Interaction** | - | **Credits: 3** | | | |

**Course Objectives**

| | |
|---|---|
| **1** | Understand importance of engineering approach to software development and comprehend the knowledge of software processes & models practiced at IT industries. |
| **2** | Be acquainted with the SDLC phases in detail and appreciate the importance of software quality by virtue of software testing methods. |
| **3** | To use conceptual designs to prepare database schemas. |
| **4** | To understand the relational model and the theoretical issues associated with relational database Design. |
| **5** | To learn SQL and Database Architectures. |

**Course Outcomes (CO) with Bloom's Taxonomy Level**

| | | |
|---|---|---|
| **CO1** | explain proficiency to undertake software projects based on software engineering practices. | Understanding |
| **CO2** | summarizing the spirit of team-working in SDLC phases & project planning benefits. | Understanding |
| **CO3** | describe the conceptual designs of Database, identifies the need, analyse the problem and Design ER diagram as well as prepare the relational database schema. | Remembering, Analysing |
| **CO4** | apply SQL to extract required information from the database. Compare, analyses various ways of writing the queries for a given problem and Differentiating database Architecture. | Analysing |

| **Module** | **Module Contents** | **Hours** |
|---|---|---|
| I | **Introduction Software Engineering Basics**<br>Software Crisis, Need of software engineering approach.<br>Software Processes: project management process, software development process models, Configuration management process, process management process. | 7 |
| II | **Software Quality & Project Planning**<br>**Notion of Software Quality:**<br>Quality objectives, Need for improvement, Software quality factors, Quality standards,<br>**Project Planning Basics:**<br>Project management plan, Cost estimation, Project scheduling, Staffing and personnel Planning, Risk management. | 6 |
| III | **Software Development Phases**<br>Software Requirement Process, Design principles, Structured design methodology, Coding Standards, levels of Testing. | 6 |
| IV | **Introduction and Database Modelling using ER Model**<br>**Introduction**: General introduction to database systems, its advantages and applications, Database System Architecture, Database users and Administrator, Data models, Database management system, Database languages, View of Database, Data | 6 |

| | | |
|---|---|---|
| | Models.<br>**ER Model**: Entity set, Entity types, attributes, Notations, Relationship sets, Relationship types, Keys- super key, candidate key, primary key, Extended Features of ER Model-Generalization, Specialization and aggregation | |
| V | **Relational Model and SQL**<br>**Relational Model**: Structure of Relational Database, Reduction of ER model into Relational schemas, Schema-instance distinction, Key, Relational algebra, Tuple relation calculus, Domain relational calculus, Example queries,<br>**SQL**: Introduction to SQL, Data definition statements with constraints, Insert, Update and Delete, Set Operations, Aggregate functions group by and having clauses, Nested Queries, Views, Joins. | 8 |
| VI | **Database Architectures**<br>Centralized &Client-Server architectures, server system architecture, Architectures for parallel databases, Distributed database concepts, Homogeneous & Heterogeneous databases, distributed data storage, data fragmentation, and replication and allocation techniques for distributed database. | 6 |

| | |
|---|---|
| | **Text Books** |
| 1 | Pankaj Jalote, "An integrated approach to S/W engineering", Narosa Publishers, 2nd Edition. |
| 2 | Abraham Silberschatz, Henry F. Korth and S. Sudarshan, Database System Concepts, Mc-Graw Hill, 4th Edition 2002 / 6th Edition 2011 |
| 3 | Pankaj Jalote, "Software Project Management in practice", Pearson education |
| | **References** |
| 1 | Roger S. Pressman, "Software Engineering: Practitioner's Approach". McGraw Hill |
| 2 | Raghu Ramakrishnan and Johannes Gehrke, Database Management Systems, 3rd Edition. 2002 |
| | **Useful Links** |
| 1 | https://www.javatpoint.com/software-engineering-tutorial |
| 2 | https://www.w3schools.com/sql/trysql.asp?filename=trysql_asc |

**CO-PO Mapping**

| | Programme Outcomes (PO) | | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | |
| **CO1** | 3 | | | | | 2 | 1 | | | | | | | | |
| **CO2** | | | 3 | | | | | | 3 | | 1 | | | | |
| **CO3** | | | 3 | 1 | | | | | | | | | | | |
| **CO4** | | 2 | | 2 | | | | | | | | | 1 | | |

The strength of mapping is to be written as 1,2,3; Where, 1: Low, 2: Medium, 3: High
Each CO of the course must map to at least one PO.

**Assessment (for Theory Course)**

The assessment is based on 2 in-semester examinations in the form of T1 (Test-1) and T2 (Test-2) of 20 marks each. Also there shall be 1 End-Sem examination (ESE) of 60 marks. T1 shall be typically on modules 1 and 2, T2 based typically on modules 3, 4 and ESE shall be on all modules with nearly 50% weightage on modules 1 to 4 and 50% weightage on modules 5, 6.

**Assessment Plan based on Bloom's Taxonomy Level (Marks) For Theory Course**

| Bloom's Taxonomy Level | | T1 | T2 | ESE | Total |
|---|---|---|---|---|---|
| 1 | Remember | 5 | 5 | 5 | 15 |
| 2 | Understand | 8 | 7 | 25 | 40 |
| 3 | Apply | | | | |
| 4 | Analyze | 7 | 8 | 30 | 45 |
| 5 | Evaluate | | | | |
| 6 | Create | | | | |
| **Total** | | **20** | **20** | **60** | **100** |

# Walchand College of Engineering, Sangli

*(Government Aided Autonomous Institute)*

**AY 2021-22**

| **Course Information** | |
|---|---|
| **Programme** | B.Tech. (Computer Science and Engineering) |
| **Class, Semester** | Third Year B. Tech., Sem VI |
| **Course Code** | |
| **Course Name** | Cloud Computing |
| **Desired Requisites:** | Operating System, Computer Networks |

| **Teaching Scheme** | | **Examination Scheme (Marks)** | | | |
|---|---|---|---|---|---|
| **Lecture** | 3 Hrs/week | **T1** | **T2** | **ESE** | **Total** |
| **Tutorial** | - | 20 | 20 | 60 | 100 |
| **Practical** | - | | | | |
| **Interaction** | - | **Credits: 3** | | | |

| **Course Objectives** | |
|---|---|
| **1** | An understanding of fundamental ideas behind Cloud Computing, the evolution of the paradigm, its applicability; benefits, as well as current and future challenges. |
| **2** | Providing basic ideas and principles in cloud management techniques, virtualization techniques and cloud software deployment considerations. |
| **3** | Exploring cloud computing driven open source and commercial systems and applications. |

| **Course Outcomes (CO) with Bloom's Taxonomy Level** | | |
|---|---|---|
| At the end of the course, the students will be able to, | | |
| **CO1** | Distinguish concepts of distributed paradigm from other computing paradigm and the mechanism of inter process communication in distributed systems. | Understanding |
| **CO2** | Describe main concepts, key technologies, strengths, and limitations of cloud computing and the possible applications for state-of-the-art cloud computing. | Understanding |
| **CO3** | Illustrate different cloud infrastructure models, cloud computing architecture and various deployment models. | Applying |
| **CO4** | Classify different hypervisors and virtualization techniques based on their characteristics. | Analyzing |
| **CO5** | Identify core issues of cloud computing such as security, privacy, and interoperability. | Analyzing |
| **CO6** | Examine the components of Open and commercial cloud platform. | Analyzing |

| **Module** | **Module Contents** | **Hours** |
|---|---|---|
| I | **Principles of distributed computing**<br>Eras of computing, Elements of distributed computing – General concepts and definitions, components of a distributed system, architectural styles for distributed computing, models for inter-process communication, Technologies for distributed computing – Remote procedure call, distributed object frameworks, service oriented computing. | 7 |
| II | **Introduction to Cloud Computing**<br>Cloud Computing (NIST Model)Introduction to Cloud Computing, History of Cloud Computing, Cloud service providers Properties, Characteristics & Disadvantages,Pros and Cons of Cloud Computing, Benefits of Cloud Computing, Cloud computing vs. Cluster computing vs. Grid computing, Role of Open Standards. | 5 |

| | | |
|---|---|---|
| III | **Cloud Computing Architecture**<br>Cloud computing stack, Comparison with traditional computing architecture (client/server), Services provided at various levels, How Cloud Computing Works, Role of Networks in Cloud computing, protocols used, Role of Web services, Service Models (XaaS), Infrastructure as a Service(IaaS), Platform as a Service(PaaS), Software as a Service(SaaS), Deployment Models:<br>Public cloud, Private cloud, Hybrid cloud, Community cloud. | 7 |
| IV | **Virtualization**<br>Introduction, characteristics of virtualized environments, Taxonomy of virtualization Techniques, Virtualization and cloud computing, Pros and Cons of virtualization, technology Examples. | 6 |
| V | **Cloud Security**<br>Type of attack, Security stack of IaaS, PaaS, SaaS, Gartner's seven cloud computing security Risks, Other cloud security issues: Virtualization, Access Control and identity Management, Application security, Data life cycle management. | 6 |
| VI | **Case Study on Open Source & Commercial Clouds**<br>Eucalyptus ,Microsoft Azure ,Amazon EC2,Google App Engine, Open Stack, Open Nebula | 8 |

| | **Text Books** |
|---|---|
| 1 | RajkumarBuyya, James Broberg, Andrzej M. Goscinski ,"Cloud Computing: Principles and Paradigms", Wiley, 1 Edition 2013 |
| 2 | GautamShroff,"Enterprise Cloud Computing - Technology, Architecture, Applications", Cambridge University Press, 2010. |
| 3 | Ronald L. Krutz, Russell Dean Vines ,"Cloud Security: A Comprehensive Guide to Secure Cloud Computing", Wiley- India,2010 |

| | **References** |
|---|---|
| 1 | Barrie Sosinsky,"Cloud Computing Bible", Wiley-India, 2010. |

| | **Useful Links** |
|---|---|
| 1 | |

**CO-PO Mapping**

| | Programme Outcomes (PO) | | | | | | | | | | | | PSO | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| **CO1** | 1 | | | | | | | | | | | | | |
| **CO2** | | 2 | | | | | | | | | | | 2 | |
| **CO3** | | 2 | | | | | | | | | | | 1 | |
| **CO4** | | 2 | | | | | | | | | | | 1 | |
| **CO5** | | 2 | | | | | | | | | | | 1 | |
| **CO6** | | 2 | 2 | | | | | | | | | | | |

The strength of mapping is to be written as 1,2,3; Where, 1:Low, 2:Medium, 3:High
Each CO of the course must map to at least one PO.

**Assessment (for Theory Course)**

The assessment is based on 2 in-semester examinations in the form of T1 (Test-1) and T2 (Test-2) of 20 marks each. Also there shall be 1 End-Sem examination (ESE) of 60 marks. T1 shall be typically on modules 1 and 2, T2 based typically on modules 3, 4 and ESE shall be on all modules with nearly 50% weightage on modules 1 to 4 and 50% weightage on modules 5, 6.

| Assessment Plan based on Bloom’s Taxonomy Level (Marks) For Theory Course | | | | | |
|---|---|---|---|---|---|
| **Bloom’s Taxonomy Level** | | **T1** | **T2** | **ESE** | **Total** |
| 1 | Remember | 10 | | 5 | 15 |
| 2 | Understand | 10 | 10 | 5 | 25 |
| 3 | Apply | | 10 | 25 | 35 |
| 4 | Analyze | | | 25 | 25 |
| 5 | Evaluate | | | | |
| 6 | Create | | | | |
| **Total** | | **20** | **20** | **60** | **100** |

# Walchand College of Engineering, Sangli

*(Government Aided Autonomous Institute)*

**AY 2021-22**

| Course Information | |
|---|---|
| **Programme** | B.Tech. (Computer Science & Engineering) |
| **Class, Semester** | Third Year B. Tech., Sem VI |
| **Course Code** | |
| **Course Name** | Advanced Database Systems |
| **Desired Requisites:** | Database Engineering |

| Teaching Scheme | | Examination Scheme (Marks) | | | |
|---|---|---|---|---|---|
| **Lecture** | 3 Hrs/week | **T1** | **T2** | **ESE** | **Total** |
| **Tutorial** | - | 20 | 20 | 60 | 100 |
| **Practical** | - | | | | |
| **Interaction** | - | **Credits: 3** | | | |

| Course Objectives | |
|---|---|
| **1** | An understanding of the fundamentals in object-based databases and explore the database centric design issues involved in application development, the advances in database system. |
| **2** | Providing the methodology to implement the complex and real-world database applications. |
| **3** | Evaluation and analysis of the different types of advanced databases. |

| Course Outcomes (CO) with Bloom's Taxonomy Level | | |
|---|---|---|
| **CO1** | **Exploit** the fundamental concepts involved in advanced databases and **apply** it in complex data handling. | Apply |
| **CO2** | **Analyse** the architectures and performance of different databases using **modern tools** for domain specific applications. | Analyse |
| **CO3** | **Recommend** the optimal database-based solution to solve real world problem. | Evaluate |
| **CO4** | **Apply** the acquired knowledge in databases to **design** and **build** the different business applications. | Create |

| Module | Module Contents | Hours |
|---|---|---|
| I | **Object-Based Databases**<br>Overview, Complex Data Types, Structure Types and Inheritance in SQL, Table Inheritance, Arrays and Multiset Types in SQL, Object-Identity and Reference Types in SQL, Implementing O-R Features, Object-Relational Mapping | **5** |
| II | **Application development & Administration**<br>Application Programs and User Interfaces, Application Architectures, Standardization, Rapid Application Development, Application Performance, Application Security. Performance Tuning, Performance Benchmarks, Other issues in Application Development | 6 |
| III | **Parallel and Distributed databases**<br>**Parallel databases :** I/O parallelism, inter-query parallelism, intra-query Parallelism, intra-operation parallelism, inter-operation parallelism, Query Optimization. | 4 |
| | **Distributed databases:** Homogeneous & heterogeneous databases, distributed data storage, distributed transactions, concurrency control in distributed databases, distributed query processing, Heterogeneous distributed databases. | 4 |

| | | |
|---|---|---|
| IV | **Cloud Databases – I**<br>Introduction, Architecture of a cloud data storage system, Data Models, Transactions and replication, Deployment models, Comparison of Relational databases and Cloud databases, Challenges to develop Cloud Databases. | 5 |
| V | **Cloud Databases – II**<br>Case study of following NoSQL databases: Voldemort , MongoDB , Cassandra , Neo4J , Cloud Native , Data Lake | 8 |
| VI | **Spatial, Temporal Data and Mobility**<br>Motivation, Time in Databases, Spatial and Geographic Data, Multimedia Databases, Mobility and Personal Databases. | 6 |

| | |
|---|---|
| | **Text Books** |
| 1 | Silberschatz, Korth, Sudarshan "Database system concepts" MGH 6th Edition. |
| 2 | Raghu Ramkrishnan "Database Management System" MGH |

| | |
|---|---|
| | **References** |
| 1 | Thomas Connolly & Carolyn Begg "Database Systems : A practical approach to design, implementation & Management" Pearson 3rd Edition |
| 2 | RamezElmasri and ShamkantNavathe, "Fundamentals of Database Systems" Benjamin Cummings, 2nd Ed, 1994. |
| 3 | Open source databases official websites |

| | |
|---|---|
| | **Useful Links** |
| 1 | https://nptel.ac.in/courses/106/106/106106093/ |
| 2 | https://freevideolectures.com/course/2280/database-design/37 |
| 3 | https://onlinecourses.nptel.ac.in/noc21_cs04/preview |
| 4 | https://onlinecourses.nptel.ac.in/noc21_cs58/preview |

**CO-PO Mapping**

| | Programme Outcomes (PO) | | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 |
| **CO1** | 3 | | | | | | | | | | | | 2 | | |
| **CO2** | | | | | 2 | | | | | | | | 2 | 2 | |
| **CO3** | | | 2 | | | | | | | | | | 2 | | |
| **CO4** | | | 3 | | | | | | | | | | 1 | 3 | |

The strength of mapping is to be written as 1,2,3; Where, 1:Low, 2:Medium, 3:High
Each CO of the course must map to at least one PO.

**Assessment (for Theory Course)**

The assessment is based on 2 in-semester examinations in the form of T1 (Test-1) and T2 (Test-2) of 20 marks each. Also there shall be 1 End-Sem examination (ESE) of 60 marks. T1 shall be typically on modules 1 and 2, T2 based typically on modules 3, 4 and ESE shall be on all modules with nearly 50% weightage on modules 1 to 4 and 50% weightage on modules 5, 6.

**Assessment Plan based on Bloom's Taxonomy Level (Marks) For Theory Course**

| Bloom's Taxonomy Level | | T1 | T2 | ESE | Total |
|---|---|---|---|---|---|
| 1 | Remember | | | | |
| 2 | Understand | | | | |
| 3 | Apply | 5 | 5 | 12 | 22 |
| 4 | Analyze | 5 | 5 | 12 | 22 |
| 5 | Evaluate | 4 | 4 | 11 | 19 |
| 6 | Create | 6 | 6 | 25 | 37 |
| **Total** | | **20** | **20** | **60** | **100** |

# Walchand College of Engineering, Sangli

*(Government Aided Autonomous Institute)*

**AY 2021-22**

| Course Information | |
|---|---|
| **Programme** | B.Tech. (Computer Science and Engineering) |
| **Class, Semester** | Third Year B. Tech., Sem VI |
| **Course Code** | |
| **Course Name** | Advanced Database System Laboratory |
| **Desired Requisites:** | Database Engineering |

| **Teaching Scheme (Hrs)** | | **Examination Scheme (Marks)** | | | |
|---|---|---|---|---|---|
| **Lecture** | - | **LA1** | **LA2** | **ESE** | **Total** |
| **Tutorial** | - | 30 | 30 | 40 | 100 |
| **Practical** | 2 | | | | |
| **Interaction** | - | **Credits: 1** | | | |

| **Course Objectives** | |
|---|---|
| **1** | Practicing the concepts/techniques studied in theory course. |
| **2** | Providing hands-on with different database servers / platforms / tools. |
| **3** | Designing and implementation of the database based applications. |

| **Course Outcomes (CO) with Bloom's Taxonomy Level** | | |
|---|---|---|
| **CO1** | **Scrutinize** different database servers, application architectures / models, frameworks and **identify** optimal one, suitable for particular application. | Analyze |
| **CO2** | **Select** the advanced/modern databases and **recommend** for prediction and modelling of complex real world data. | Evaluate |
| **CO3** | **Design** and **build** the different enterprise applications using modern tools. | Create |

## List of Experiments / Lab Activities

**List of Experiments:**

1. Minimum 12 assignments or 6 mini-projects should be practice/perform based on the understanding of concepts covered in theory course.
2. The detail list of assignments/mini-projects will be display by subject teacher.
3. Explore to all the state of the art technology related to each module in theory course.
4. Use industry standard development tools for above laboratory work.
5. All assignments/laboratory work should follow software engineering standards.

| **Text Books** | |
|---|---|
| 1 | Silberschatz, Korth, Sudarshan "Database system concepts" MGH 4th Edition |
| 2 | Raghu Ramkrishnan "Database Management System" MGH |

| **References** | |
|---|---|
| 1 | Thomas Connolly & Carolyn Begg "Database Systems : A practical approach to design, implementation & Management" Pearson 3rd Edition |
| 2 | RamezElmasri and ShamkantNavathe, "Fundamentals of Database Systems" Benjamin Cummings 2nd Ed, 1994 |
| 3 | Official websites of open source databases |

| **Useful Links** | |
|---|---|
| 1 | Parallel processing :- https://docs.oracle.com/cd/A58617_01/server.804/a58238/ch2_succ.htm |
| 2 | Distributed database:- https://docs.oracle.com/database/121/ADMIN/ds_concepts.htm#ADMIN12134 |

| | |
|---|---|
| 3 | www.mongodb.com , https://cassandra.apache.org |
| 4 | https://neo4j.com/developer/cypher/ |

| **CO-PO Mapping** | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Programme Outcomes (PO)** | | | | | | | | | | | | **PSO** | | |
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 |
| **CO1** | | | | 2 | | | | | | | | | 2 | | |
| **CO2** | | | | | 2 | | | | | | | | 2 | | |
| **CO3** | | | | | 3 | | | | | | 1 | | 2 | 3 | |
| | | | | | | | | | | | | | | | |

The strength of mapping is to be written as 1,2,3; Where, 1:Low, 2:Medium, 3:High
Each CO of the course must map to at least one PO.

**Assessment**

There are three components of lab assessment, LA1, LA2 and Lab ESE.
IMP: Lab ESE is a separate head of passing. LA1, LA2 together is treated as In-Semester Evaluation.

| **Assessment** | **Based on** | **Conducted by** | **Typical Schedule (for 26-week Sem)** | **Marks** |
|---|---|---|---|---|
| LA1 | Lab activities, attendance, journal | Lab Course Faculty | During Week 1 to Week 6<br>Marks Submission at the end of Week 6 | 30 |
| LA2 | Lab activities, attendance, journal | Lab Course Faculty | During Week 7 to Week 12<br>Marks Submission at the end of Week 12 | 30 |
| Lab ESE | Lab activities, attendance, journal | Lab Course Faculty | During Week 15 to Week 18<br>Marks Submission at the end of Week 18 | 40 |

Week 1 indicates starting week of a semester. The typical schedule of lab assessments is shown, considering a 26-week semester. The actual schedule shall be as per academic calendar. Lab activities/Lab performance shall include performing experiments, mini-project, presentations, drawings, programming and other suitable activities, as per the nature and requirement of the lab course. The experimental lab shall have typically 8-10 experiments.

**Assessment Plan based on Bloom's Taxonomy Level (Marks) (For lab Courses)**

| **Bloom's Taxonomy Level** | **LA1** | **LA2** | **Lab ESE** | **Total** |
|---|---|---|---|---|
| Remember | | | | |
| Understand | | | | |
| Apply | | | | |
| Analyze | 10 | 10 | 12 | **32** |
| Evaluate | 5 | 5 | 8 | **18** |
| Create | 15 | 15 | 20 | **50** |
| **Total Marks** | **30** | **30** | **40** | **100** |

| Walchand College of Engineering, Sangli<br>*(Government Aided Autonomous Institute)* | |
|---|---|
| **AY 2021-22** | |
| **Course Information** | |
| **Programme** | B.Tech. (Computer science and engineering) |
| **Class, Semester** | Third Year B. Tech., Sem VI |
| **Course Code** | |
| **Course Name** | Mini Project – 3 |
| **Desired Requisites:** | Nil |

| **Teaching Scheme** | | **Examination Scheme (Marks)** | | | |
|---|---|---|---|---|---|
| **Lecture** | - | **LA1** | **LA2** | **LA3** | **Total** |
| **Tutorial** | - | 30 | 30 | 40 | 100 |
| **Practical** | 2 | | | | |
| **Interaction** | - | **Credits: 1** | | | |

| **Course Objectives** | |
|---|---|
| **1** | To use latest design and development tools |
| **2** | To undergo project management techniques and project design principles. |
| **3** | To implement the project with appropriate programming languages and testing tools |
| **4** | To develop analytical vision and skills to analyse, compare the outcome with other techniques |

| **Course Outcomes (CO) with Bloom's Taxonomy Level** | | |
|---|---|---|
| **CO1** | demonstrate present technological trends through seminar and presentation | Remember |
| **CO2** | demonstrate the appropriate selection of software tool for project implementation | Understand |
| **CO3** | work in teams and participate in group activity of software development. | Apply |
| **CO4** | develop a software product and demonstrate its significance | Evaluate |

## List of Experiments / Lab Activities

**List of Experiments:**

1. The theme of **Mini Project 3 should be based on current or previous semester courses completed, focus should be more on the courses which doesn't have lab course (Preference should give to the course which are not covered in previous Miniproject 1/2 task).**
2. Students should maintain a project log book containing weekly progress of the project
3. At the end of the semester project group should achieve all the proposed objectives of the problem statement.
4. The work should be completed in all aspects of design, implementation and testing.
5. Project report should be prepared and submitted in soft and hard form along with all the code and datasets.
6. Group should demonstrate the work with various test cases and results obtained and explain future scope.
7. The group should participate in technical symposiums, paper presentations to demonstrate their work and findings in technical community.

| **Text Books** | |
|---|---|
| 1 | Nil |

| **References** | |
|---|---|
| 1 | Nil |

| **Useful Links** | |
|---|---|
| 1 | Nil |

| CO-PO Mapping | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Programme Outcomes (PO) | | | | | | | | | | | | PSO | | |
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 |
| **CO1** | 2 | | | | | | | | | | | | 3 | 3 | |
| **CO2** | 2 | 3 | | | | | | | | | | | 3 | 3 | |
| **CO3** | | 2 | | 3 | 2 | | | | | | | | 2 | | |
| **CO4** | 2 | | | | | | | | | | 3 | | | 3 | |
| The strength of mapping is to be written as 1,2,3; Where, 1:Low, 2:Medium, 3:High<br>Each CO of the course must map to at least one PO. | | | | | | | | | | | | | | | |

| Assessment | | | | |
|---|---|---|---|---|
| There are three components of lab assessment, LA1, LA2 and Lab ESE.<br>IMP: Lab ESE is a separate head of passing. LA1, LA2 together is treated as In-Semester Evaluation. | | | | |
| **Assessment** | **Based on** | **Conducted by** | **Typical Schedule (for 26-week Sem)** | **Marks** |
| LA1 | Lab activities, attendance, journal | Lab Course Faculty | During Week 1 to Week 6<br>Marks Submission at the end of Week 6 | 30 |
| LA2 | Lab activities, attendance, journal | Lab Course Faculty | During Week 7 to Week 12<br>Marks Submission at the end of Week 12 | 30 |
| Lab ESE | Lab activities, attendance, journal | Lab Course Faculty | During Week 15 to Week 18<br>Marks Submission at the end of Week 18 | 40 |
| Week 1 indicates starting week of a semester. The typical schedule of lab assessments is shown, considering a 26-week semester. The actual schedule shall be as per academic calendar. Lab activities/Lab performance shall include performing experiments, mini-project, presentations, drawings, programming and other suitable activities, as per the nature and requirement of the lab course. The experimental lab shall have typically 8-10 experiments. | | | | |

| Bloom's Taxonomy Level | LA1 | LA2 | ESE | Total |
|---|---|---|---|---|
| Remember | | | | |
| Understand | 15 | 5 | 5 | **25** |
| Apply | 15 | 15 | 10 | **40** |
| Analyze | | 10 | 25 | **35** |
| Evaluate | | | | |
| Create | | | | |
| **Total** | **30** | **30** | **40** | **100** |

# Walchand College of Engineering, Sangli

*(Government Aided Autonomous Institute)*

**AY 2021-22**

**Course Information**

| | |
|---|---|
| **Programme** | B.Tech. (Computer science and engineering) |
| **Class, Semester** | Third Year B. Tech., Sem VI |
| **Course Code** | |
| **Course Name** | Mini Project – 4 |
| **Desired Requisites:** | Nil |

| **Teaching Scheme** | | **Examination Scheme (Marks)** | | | |
|---|---|---|---|---|---|
| **Lecture** | - | **LA1** | **LA2** | **ESE** | **Total** |
| **Tutorial** | - | 30 | 30 | 40 | 100 |
| **Practical** | 2 | | | | |
| **Interaction** | - | **Credits: 1** | | | |

**Course Objectives**

| | |
|---|---|
| **1** | To use latest design and development tools |
| **2** | To undergo project management techniques and project design principles. |
| **3** | To implement the project with appropriate programming languages and testing tools |
| **4** | To develop analytical vision and skills to analyse, compare the outcome with other techniques |

**Course Outcomes (CO) with Bloom's Taxonomy Level**

| | | |
|---|---|---|
| **CO1** | demonstrate present technological trends through seminar and presentation | Remembering |
| **CO2** | demonstrate the appropriate selection of software tool for project implementation | Understanding |
| **CO3** | work in teams and participate in group activity of software development. | Applying |
| **CO4** | develop a software product and demonstrate its significance | Evaluating |

**List of Experiments / Lab Activities**

**List of Experiments:**

8. **Mini Project 4 should be on customer specific requirement useful to real life, major focus should be on Machine learning / Image Processing / Internet (Web) of Things (Preference should give to the course which are not covered in previous Miniproject 1/2/3 task).**
9. Students should maintain a project log book containing weekly progress of the project
10. At the end of the semester project group should achieve all the proposed objectives of the problem statement.
11. The work should be completed in all aspects of design, implementation and testing.
12. Project report should be prepared and submitted in soft and hard form along with all the code and datasets.
13. Group should demonstrate the work with various test cases and results obtained and explain future scope.
14. The group should participate in technical symposiums, paper presentations to demonstrate their work and findings in technical community.

**Text Books**

| | |
|---|---|
| 1 | Nil |

**References**

| | |
|---|---|
| 1 | Nil |

**Useful Links**

| | |
|---|---|
| 1 | Nil |

| CO-PO Mapping | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Programme Outcomes (PO) | | | | | | | | | | | | PSO | | |
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 |
| **CO1** | 2 | | | | | | | | | | | | 3 | 3 | |
| **CO2** | 2 | 3 | | | | | | | | | | | 3 | 3 | |
| **CO3** | | 2 | | 3 | 2 | | | | | | | | 2 | | |
| **CO4** | 2 | | | | | | | | | | 3 | | | 3 | |
| The strength of mapping is to be written as 1,2,3; Where, 1:Low, 2:Medium, 3:High<br>Each CO of the course must map to at least one PO. | | | | | | | | | | | | | | | |

| Assessment | | | | |
|---|---|---|---|---|
| There are three components of lab assessment, LA1, LA2 and Lab ESE.<br>IMP: Lab ESE is a separate head of passing. LA1, LA2 together is treated as In-Semester Evaluation. | | | | |
| **Assessment** | **Based on** | **Conducted by** | **Typical Schedule (for 26-week Sem)** | **Marks** |
| LA1 | Lab activities, attendance, journal | Lab Course Faculty | During Week 1 to Week 6<br>Marks Submission at the end of Week 6 | 30 |
| LA2 | Lab activities, attendance, journal | Lab Course Faculty | During Week 7 to Week 12<br>Marks Submission at the end of Week 12 | 30 |
| Lab ESE | Lab activities, attendance, journal | Lab Course Faculty | During Week 15 to Week 18<br>Marks Submission at the end of Week 18 | 40 |
| Week 1 indicates starting week of a semester. The typical schedule of lab assessments is shown, considering a 26-week semester. The actual schedule shall be as per academic calendar. Lab activities/Lab performance shall include performing experiments, mini-project, presentations, drawings, programming and other suitable activities, as per the nature and requirement of the lab course. The experimental lab shall have typically 8-10 experiments. | | | | |

| **Bloom's Taxonomy Level** | **LA1** | **LA2** | **ESE** | **Total** |
|---|---|---|---|---|
| Remember | 15 | | | 15 |
| Understand | 15 | 10 | 5 | 30 |
| Apply | | 15 | 15 | 30 |
| Analyze | | | | |
| Evaluate | | 5 | 20 | 25 |
| Create | | | | |
| **Total** | **30** | **30** | **40** | **100** |

# Walchand College of Engineering, Sangli

*(Government Aided Autonomous Institute)*

**AY 2021-22**

| **Course Information** | |
|---|---|
| **Programme** | B.Tech. (Computer Science and Engineering) |
| **Class, Semester** | Third Year B. Tech., Sem VI |
| **Course Code** | |
| **Course Name** | Remote Sensing & Geographic Information System |
| **Desired Requisites:** | Fundamentals of Image processing |

| **Teaching Scheme** | | **Examination Scheme (Marks)** | | | |
|---|---|---|---|---|---|
| **Lecture** | 2 Hrs/week | **T1** | **T2** | **ESE** | **Total** |
| **Tutorial** | - | 20 | 20 | 60 | 100 |
| **Practical** | - | | | | |
| **Interaction** | - | **Credits: 2** | | | |

| **Course Objectives** | |
|---|---|
| **1** | To introduce the fundamentals of Remote Sensing (RS) and geographical information systems (GIS) |
| **2** | To explore various Remote Sensing satellites, their characteristics and data products. |
| **3** | To inculcate advantages, limitations and interdisciplinary applications of RS and GIS. |
| | |

| **Course Outcomes (CO) with Bloom's Taxonomy Level** | | |
|---|---|---|
| **CO1** | Explain fundamental concepts of RS and GIS | Understand |
| **CO2** | Interpret and Apply various satellite sensor data and data products | Apply |
| **CO3** | Demonstrate GIS data and GIS database management system | Apply |
| **CO4** | Compare and Analyze RS and GIS data using modern tools and techniques | Analyze |
| **CO5** | Select and Verify suitable RS and GIS data and data products to design solution for various interdisciplinary problems using RS and GIS tools and techniques. | Evaluate |

| **Module** | **Module Contents** | **Hours** |
|---|---|---|
| I | **Concepts and Foundation of Remote Sensing**<br>Introduction, Remote Sensing System, Electromagnetic Energy, Electromagnetic Spectrum and its Characteristics, Energy Interaction in the Atmosphere and with the Earth‟s Surface, Resolution in Remote Sensing, Applications of Remote Sensing. | 5 |
| II | **Sensors, Platforms and Satellite Data Products**<br>Broad Classifications of Sensors and Platform, Earth Observation Satellite and Sensors, Data Reception, Transmission and Processing, Remote Sensing Data and Data Products | 4 |
| III | **Satellite Image Interpretation and Processing**<br>Interpretation Procedure and Elements, Interpretation strategies and keys, Digital Image processing and Image Analysis steps, Image Rectification and Restoration, Image Enhancement, Image Transformation | 4 |
| IV | **GIS – An Overview**<br>Introduction, Geographical concepts and Terminology, Difference between Image<br>Processing system and GIS, Various GIS packages and their salient features, Essentials components of GIS, Utility of GIS, Applications of GIS, GPS | 5 |
| V | **GIS Data**<br>Introduction, GIS Data types and Data Representation, Data Acquisition, Georeferencing of GIS Data, Raster and Vector data, Remote Sensing | 4 |

| | | |
|---|---|---|
| | Data in GIS, GIS Database and Database Management System | |
| VI | **Spatial Data Analysis**<br>Measurements in GIS-Lengths, Perimeters, and Areas, Queries, Reclassification, Buffering and Neighborhood Functions, Map Overlay, Spatial Interpolation | 4 |

| **Text Books** | |
|---|---|
| 1 | Chandra, A.M. and Ghosh, S.K., "Remote Sensing and GIS", Narosa Publishing House. 2008 |
| 2 | Lo, C.P. and Young, A.K.W., "Concepts and Techniques of Geographical Information System", Prentice Hall India. 20012 |

| **References** | |
|---|---|
| 1 | Lillesand, T.M. and Kieffer, "Remote Sensing and Image Interpretation", - 6th Edition, John Wiley and Sons. 2012 |
| 2 | Chang, K, "Introduction to Geographical Systems", 4th Edition, Tata McGraw-Hill. 2010 |

| **Useful Links** | |
|---|---|
| 1 | https://nptel.ac.in/noc/courses/noc19/SEM1/noc19-ce08 |
| 2 | https://nptel.ac.in/noc/courses/noc18/SEM1/noc18-ce10 |
| 3 | https://www.usgs.gov |
| 4 | https://bhuvan.nrsc.gov.in/bhuvan_links.php# |

**CO-PO Mapping**

| | **Programme Outcomes (PO)** | | | | | | | | | | | | **PSO** | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | |
| **CO1** | 2 | | | | | | | | | | | | | | |
| **CO2** | 3 | | | | | | | | | | | | 2 | | |
| **CO3** | 3 | | | | | | | | | | | | 2 | | |
| **CO4** | | 2 | | | 3 | | | | | | | | 3 | 3 | |
| **CO5** | | | 2 | | 2 | | | | | | | | 3 | 2 | |

The strength of mapping is to be written as 1,2,3; Where, 1:Low, 2:Medium, 3:High
Each CO of the course must map to at least one PO.

**Assessment (for Theory Course)**

The assessment is based on 2 in-semester examinations in the form of T1 (Test-1) and T2 (Test-2) of 20 marks each. Also there shall be 1 End-Sem examination (ESE) of 60 marks. T1 shall be typically on modules 1 and 2, T2 based typically on modules 3, 4 and ESE shall be on all modules with nearly 50% weightage on modules 1 to 4 and 50% weightage on modules 5, 6.

**Assessment Plan based on Bloom's Taxonomy Level (Marks) For Theory Course**

| **Bloom's Taxonomy Level** | | **T1** | **T2** | **ESE** | **Total** |
|---|---|---|---|---|---|
| 1 | Remember | | | | |
| 2 | Understand | 10 | 7 | 25 | 42 |
| 3 | Apply | 10 | 5 | 20 | 35 |
| 4 | Analyze | | 5 | 8 | 13 |
| 5 | Evaluate | | 3 | 7 | 10 |
| 6 | Create | | | | |
| **Total** | | **20** | **20** | **60** | **100** |

| Walchand College of Engineering, Sangli<br>*(Government Aided Autonomous Institute)* | |
|---|---|
| **AY 2021-22** | |
| **Course Information** | |
| **Programme** | B. Tech. (Computer Science and Engineering) |
| **Class, Semester** | Third Year B. Tech., Sem VI |
| **Course Code** | |
| **Course Name** | Advanced Computer Network |
| **Desired Requisites:** | Computer Networks |

| **Teaching Scheme** | | **Examination Scheme (Marks)** | | | |
|---|---|---|---|---|---|
| **Lecture** | 2 Hrs/week | **T1** | **T2** | **ESE** | **Total** |
| **Tutorial** | - | 20 | 20 | 60 | 100 |
| **Practical** | - | | | | |
| **Interaction** | - | **Credits: 2** | | | |

| **Course Objectives** | |
|---|---|
| **1** | Build an understanding of the fundamental concepts of wireless, mobile, ad hoc and Wireless Sensor Networks. |
| **2** | Develop an understanding of different components of computer networks, various protocols, routing algorithms, modern technologies and their applications. |
| **3** | Introduce the students to advanced networking concepts such as DWDM, WSNs, ATM and MPLS. |
| **4** | Allow the student to gain expertise in some specific areas of networking such as Network designing and Management. |

| **Course Outcomes (CO) with Bloom's Taxonomy Level** | | |
|---|---|---|
| **CO1** | Understand fundamental concepts of Wireless, Mobile, Ad Hoc, Sensor, Optical and ATM networks operation | Understand |
| **CO2** | Choose appropriate protocol for desired communication service | Apply |
| **CO3** | Compare various types of routing protocols | Analyse |
| **CO4** | Evaluate advanced network technologies and network protocols | Evaluate |

| **Module** | **Module Contents** | **Hours** |
|---|---|---|
| I | **Wireless and Mobile Networks**<br>Wired communication system, wireless communication system- paging system, cordless telephone system, cellular mobile system, Bluetooth. Wireless Local Area Network (WLAN), Wireless Generations-1G, 2G, 2.5G, 3G, 4G, 5G. Introduction to Cellular mobile Systems-GSM, CDMA. Cellular system design fundamental. | 5 |
| II | **Ad Hoc and Wireless Sensor Networks**<br>Ad Hoc Networks-Elements of Ad hoc Wireless Networks, Issues in Ad hoc wireless networks, Example commercial applications of Ad hoc networking, Ad hoc wireless Internet, Issues in Designing a Routing Protocol for Ad Hoc Wireless Networks, Classifications of Routing Protocols, Table Driven Routing Protocols - Destination Sequenced Distance Vector (DSDV), On–Demand Routing protocols –Ad hoc On–Demand Distance Vector Routing (AODV).<br>Wireless Sensor Networks- Challenges for Wireless Sensor Networks, Enabling Technologies for Wireless Sensor Networks, WSN application examples, Network Architecture | 5 |
| III | **Optical Networking**<br>SONET/SDH standards, Dense Wavelength division multiplexing (DWDM), Performance and design Considerations | 4 |

| | | |
|---|---|---|
| IV | **ATM: The WAN Protocol**<br>Faces of ATM, ATM Protocol operations (ATM cell and Transmission) ATM Networking basics, Theory of Operations, B-ISDN reference model, PHY layer, ATM Layer (Protocol model), ATM layer and cell, Traffic Descriptor and parameters, Traffic Congestion control defined, AAL Protocol model, Traffic contract and QoS, User Plane overview, Control Plane AAL, Management Plane, Sub-DS3 ATM, ATM public services. | 5 |
| V | **Routing in the Internet**<br>Routing in the Internet: Intra and inter domain routing; Unicast Routing Protocols: RIP, OSPF, BGP; Multicast Routing Protocols: MOSPF, DVMRP, Drawbacks of traditional routing methods, Idea of TE, TE and Different Traffic classes. IP over ATM, Multi-protocol Label switching (MPLS), Storage Area Networks (SAN). | 5 |
| VI | **Network Management**<br>SNMP: Concept, Management Components, SMI, MIB, SNMP format, Messages, Backbone Network Design: Backbone Requirements, Network Capacities Topologies, Topologies Strategies, Tuning Network. | 4 |

| | |
|---|---|
| | **Text Books** |
| 1 | Darren L Spohn, "*Data Network Design*", TMH |
| 2 | Clint Smith and Daniel Collins , "*Wireless networks : design and integration for LTE, EVDO, HSPA, and WiMAX*" , McGraw-Hill Education |
| | **References** |
| 1 | "*Computer Networking: A Top-Down Approach featuring the Internet*", 3e by James F.Kurose. |
| 2 | Peterson and Davie, *Computer Networks: A Systems Approach*, Morgan Kaufman, 2003, 3rd edition (ISBN: 155860832X). |
| 3 | "*Ad Hoc Wireless Networks Architectures and Protocols*", by C. Siva Ram Murthy, B.S. Manoj |
| | **Useful Links** |
| 1 | https://www.youtube.com/watch?app=desktop&v=sFhQzxAZzrw |
| 2 | https://www.youtube.com/watch?v=Sz1PThotOUQ |
| 3 | https://www.youtube.com/watch?v=BuIWNecUAE8 |

**CO-PO Mapping**

| | Programme Outcomes (PO) | | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 |
| **CO1** | 3 | 2 | | | | | | | | | | | 3 | 2 | |
| **CO2** | 3 | 3 | | | | | | | | | | | 3 | 2 | |
| **CO3** | 3 | 2 | 3 | | | | | | | | | | 3 | 2 | |
| **CO4** | 3 | 2 | 3 | | | | | | | | | | 3 | 2 | |

The strength of mapping is to be written as 1,2,3; Where, 1:Low, 2:Medium, 3:High
Each CO of the course must map to at least one PO.

**Assessment**

The assessment is based on 2 in-semester examinations in the form of T1 (Test-1) and T2 (Test-2) of 20 marks each. Also there shall be 1 End-Sem. examination (ESE) of 60 marks. T1 shall be typically on modules 1 and 2, T2 based typically on modules 3, 4 and ESE shall be on all modules with nearly 50% weightage on modules 1 to 4 and 50% weightage on modules 5, 6.

| Assessment Plan based on Bloom's Taxonomy Level (Marks) | | | | | |
|---|---|---|---|---|---|
| **Bloom's Taxonomy Level** | | **T1** | **T2** | **ESE** | **Total** |
| 1 | Remember | | | | |
| 2 | Understand | 10 | 10 | 15 | 35 |
| 3 | Apply | | 5 | 15 | 20 |
| 4 | Analyse | 10 | 5 | 15 | 30 |
| 5 | Evaluate | | | 15 | 15 |
| 6 | Create | | | | |
| **Total** | | **20** | **20** | **60** | **100** |

# Walchand College of Engineering, Sangli

*(Government Aided Autonomous Institute)*

## AY 2021-22

| Course Information | |
|---|---|
| **Programme** | B.Tech. (Computer Science and Engineering) |
| **Class, Semester** | Third Year B. Tech., Sem VI |
| **Course Code** | |
| **Course Name** | Deep Learning |
| **Desired Requisites:** | Working knowledge of Linear Algebra, Statistics and Probability Theory |

| **Teaching Scheme** | | **Examination Scheme (Marks)** | | | |
|---|---|---|---|---|---|
| **Lecture** | 2 Hrs/week | **T1** | **T2** | **ESE** | **Total** |
| **Tutorial** | - | 20 | 20 | 60 | 100 |
| **Practical** | - | | | | |
| **Interaction** | - | **Credits: 2** | | | |

| **Course Objectives** | |
|---|---|
| **1** | To explain the fundamentals of neural networks, recurrent neural networks (RNN), long short term memory cells and convolutional neural networks (CNN). |
| **2** | To demonstrate various learning models for practical application. |
| **3** | To discuss CNN, RNN and Generative model according to accuracy and speed evaluation parameter's |
| **4** | |

| **Course Outcomes (CO) with Bloom's Taxonomy Level** | | |
|---|---|---|
| **CO1** | Illustrate fundamentals of deep learning using foundation of mathematics terminology | Understanding |
| **CO2** | Compare various deep learning models by hyper tuning various parameters | Analyzing |
| **CO3** | Demonstrate various case studies of deep learning. | Applying |
| **CO4** | Design and deploy deep learning models on various frameworks and platform. | Creating |

| **Module** | **Module Contents** | **Hours** |
|---|---|---|
| I | **Introduction to Deep Learning**<br>Neural network fundamentals: General Introduction to Deep Learning, Perceptron algorithm, Back propagation and Multi-layer Networks.<br>Image fundamentals: Pixels, Image coordinate, scaling and aspect ratios | 5 |
| II | **Parameterized Learning and Optimization Methods**<br>parameterized Learning: Introduction to linear classification, Four components of parameterized learning, role of loss function.<br>Optimization Methods: Optimization Methods: Gradient descent, stochastic gradient descent (SGD) and extensions to SGD, regularization | 4 |
| III | **Convolutional Neural Networks (CNN)** | 5 |

| | | |
|---|---|---|
| | Understanding Convolutions: Convolutions versus Cross-correlation, The “Big Matrix” and “Tiny Matrix" Analogy, Kernels, A Hand Computation Example of Convolution The Role of Convolutions in Deep Learning.<br>CNN Building blocks: Layer Types, Convolutional Layers, Activation Layers , Pooling Layers , Fully-connected Layers , Batch Normalization , Dropout, ShallowNEt, LeNet, MiniVGGNET | |
| IV | **Deep learning based object detection**<br>Fundamentals of Object detection, Family of R-CNN, Single shot detectors (SSD), You only look once (YOLO) | 4 |
| V | **Sequence Models**<br>Recurrent Neural Networks, Vanishing gradients, Gated Recurrent Units (GRU), Long-short-term-memories (LSTMs) | 4 |
| VI | **Generative Models**<br>Autoencoders, Variational Autoencoders, Generative Adversarial Networks | 4 |

| **Text Books** | |
|---|---|
| 1 | Ian Goodfellow, Yoshua Bengio and Aaron Courville Deep Learning, MIT Press, 2016 |
| 2 | Aurelien Geron, “ Hands-On Machine Learning with Scikit-Learn & TensorFlow”, O’REILLY, Dec 2017 |

| **References** | |
|---|---|
| 1 | Neural Networks: A Systematic Introduction, Raúl Rojas, 1996 |
| 2 | Pattern Recognition and Machine Learning, Christopher Bishop, 2007 |
| 3 | Prof. Mitesh M. Khapra, “Deep Learning”, course on NPTEL, July 2018 |
| 4 | Andrew Ng, “Deep Learning Specialization”, Coursera online course |

| **Useful Links** | |
|---|---|
| 1 | https://nptel.ac.in/courses/106/106/106106184/ |
| 2 | https://www.coursera.org/specializations/deep-learning |

**CO-PO Mapping**

| | **Programme Outcomes (PO)** | | | | | | | | | | | | **PSO** | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 |
| **CO1** | 2 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | |
| **CO2** | -- | 2 | -- | 1 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | |
| **CO3** | -- | -- | 2 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 1 | |
| **CO4** | -- | -- | 3 | -- | 1 | -- | -- | -- | -- | -- | -- | -- | -- | 2 | |

The strength of mapping is to be written as 1,2,3; Where, 1:Low, 2:Medium, 3:High
Each CO of the course must map to at least one PO.

**Assessment (for Theory Course)**

The assessment is based on 2 in-semester examinations in the form of T1 (Test-1) and T2 (Test-2) of 20 marks each. Also there shall be 1 End-Sem examination (ESE) of 60 marks. T1 shall be typically on modules 1 and 2, T2 based typically on modules 3, 4 and ESE shall be on all modules with nearly 50% weightage on modules 1 to 4 and 50% weightage on modules 5, 6.

**Assessment Plan based on Bloom’s Taxonomy Level (Marks) For Theory Course**

| **Bloom’s Taxonomy Level** | | **T1** | **T2** | **ESE** | **Total** |
|---|---|---|---|---|---|
| 1 | Remember | | | | |
| 2 | Understand | 10 | 5 | 10 | 25 |
| 3 | Apply | 5 | 7 | 10 | 22 |
| 4 | Analyze | 5 | 8 | 20 | 33 |
| 5 | Evaluate | | | | |

| | | | | | |
|---|---|---|---|---|---|
| 6 | Create | | | 20 | 20 |
| **Total** | | **20** | **20** | **60** | **100** |

| Walchand College of Engineering, Sangli<br>*(Government Aided Autonomous Institute)* | | | | | |
|---|---|---|---|---|---|
| **AY 2021-22** | | | | | |
| **Course Information** | | | | | |
| **Programme** | | B.Tech. (Computer Science & Engineering) | | | |
| **Class, Semester** | | Third Year B. Tech., Sem VI | | | |
| **Course Code** | | | | | |
| **Course Name** | | Soft Computing | | | |
| **Desired Requisites:** | | | | | |
| | | | | | |
| **Teaching Scheme** | | **Examination Scheme (Marks)** | | | |
| **Lecture** | 2 Hrs/week | **T1** | **T2** | **ESE** | **Total** |
| **Tutorial** | - | 20 | 20 | 60 | 100 |
| **Practical** | - | | | | |
| **Interaction** | - | **Credits: 2** | | | |

| **Course Objectives** | |
|---|---|
| **1** | Understand comparative performance of soft and hard computing approaches. |
| **2** | Provide to students a sound foundation of mathematical, scientific and engineering principles to formulate, solve and analyse learning problems using soft computing. |
| **3** | Imbibe capability for innovation in soft computing. |
| **4** | Understand hybrid applications of ANN, Fuzzy and GA |
| | |

| **Course Outcomes (CO) with Bloom's Taxonomy Level** | | |
|---|---|---|
| At the end of the course, the students will be able to, | | |
| **CO1** | Interpret soft computing schemes using knowledge of discrete mathematics, data structures, theory of computer science and computer architectures. | Understand |
| **CO2** | Demonstrate machine learning processes. | Apply |
| **CO3** | Compare and analyse soft computing schemes. | Analyse |
| **CO4** | Design schemes using soft computing | Create |
| **CO5** | Evaluate various schemes of soft computing | Evaluate |

| **Module** | **Module Contents** | **Hours** |
|---|---|---|
| I | **Module 1 Fundamentals of Neural Networks**<br>Basics: Human Brain, Model of Artificial Neuron, Neural Network Architectures, Characteristics of Neural Networks, Learning Methods; McCulloch-Pitts model. | 4 |
| II | **Back propagation Networks (BPN)**<br>BPN Architecture, Back propagation learning, applications: Parity Problem, Encoder Decoder, NETtalk and DEC-talk, Character Recognition, Cognitron; CNN, RCNN. | 5 |
| III | **Unsupervised Learning**<br>Introductions, ARTI Architecture, ART1 Algorithm, Applications of ART1 | 4 |
| IV | **Fuzzy Systems**<br>Fuzzy logic: Fuzzy Quantifiers, Fuzzy Inference; Fuzzy Rule Based System; Defuzzification Methods, Applications. | 4 |
| V | **Genetic Algorithm**<br>Fundamentals: Biological background, Creation of Offsprings, Working Principle, Encoding, Reproduction ; Mathematical Foundations; Data Structure: Mutation, Crossover, Selection; Applications | 6 |

| | | |
|---|---|---|
| VI | **Hybrid Systems**<br>Integration of neural networks, fuzzy logic and genetic algorithms: Hybrid Systems; Neuro-Fuzzy hybrids, Neuro-Evolutionary Hybrids, Fuzzy-Evolutionary Hybrids, GA-based BPN, Simplified Fuzzy ARTMAP. | 3 |

| | |
|---|---|
| | **Text Books** |
| 1 | "Neural Networks, Fuzzy Logic and Genetic Algorithms",S. Rajasekaran, G.A.VijayalakshmiPai, PHI (ECE). |
| | **References** |
| 1 | MIT-OCW |
| 2 | Hertz, Krogh, Palmer"Introduction to the Theory of Neural Computation" |
| 3 | B. Yegnanarayana, PHI, "Artificial Neural Networks" |
| 4 | David E. Goldberg, Addison Wesley, "Genetic Algorithms" |
| | **Useful Links** |
| 1 | https://cse.iitkgp.ac.in/~dsamanta/courses/sca/index.html |

**CO-PO Mapping**

| | Programme Outcomes (PO) | | | | | | | | | | | | PSO | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| **CO1** | 2 | | | | | | | | | | | | | |
| **CO2** | | | 3 | | | | | | | | | | 3 | |
| **CO3** | | 3 | | 2 | | | | | | | | | | |
| **CO4** | | | 3 | | | | | | | | | | 3 | |
| **CO5** | | | | 3 | | | | | | | | | | |

The strength of mapping is to be written as 1,2,3; Where, 1:Low, 2:Medium, 3:High
Each CO of the course must map to at least one PO.

**Assessment (for Theory Course)**

The assessment is based on 2 in-semester examinations in the form of T1 (Test-1) and T2 (Test-2) of 20 marks each. Also there shall be 1 End-Sem examination (ESE) of 60 marks. T1 shall be typically on modules 1 and 2, T2 based typically on modules 3, 4 and ESE shall be on all modules with nearly 50% weightage on modules 1 to 4 and 50% weightage on modules 5, 6.

**Assessment Plan based on Bloom's Taxonomy Level (Marks) For Theory Course**

| Bloom's Taxonomy Level | | T1 | T2 | ESE | Total |
|---|---|---|---|---|---|
| 1 | Remember | 5 | | 5 | 10 |
| 2 | Understand | 5 | 5 | 10 | 20 |
| 3 | Apply | 8 | 12 | 20 | 40 |
| 4 | Analyze | 2 | | 10 | 12 |
| 5 | Evaluate | | | 5 | 5 |
| 6 | Create | | 3 | 10 | 13 |
| **Total** | | **20** | **20** | **60** | **100** |

| **Walchand College of Engineering, Sangli**<br>*(Government Aided Autonomous Institute)* | |
|---|---|
| **AY 2021-22** | |
| **Course Information** | |
| **Programme** | B.Tech. (Computer Science and Engineering) |
| **Class, Semester** | Third Year B. Tech., Sem VI |
| **Course Code** | |
| **Course Name** | Advanced Web and Mobile Application Development Lab |
| **Desired Requisites:** | Programming Lab-3 |

| **Teaching Scheme (Hrs)** | | **Examination Scheme (Marks)** | | | |
|---|---|---|---|---|---|
| **Lecture** | - | **LA1** | **LA2** | **ESE** | **Total** |
| **Tutorial** | - | 30 | 30 | 40 | 100 |
| **Practical** | 2 | | | | |
| **Interaction** | - | **Credits: 1** | | | |

| **Course Objectives** | |
|---|---|
| **1** | to inculcate understanding of state-of-the-art front-end and back-end development frameworks of web programming and mobile app development tools. |
| **2** | to introduce selection of appropriate concepts from different state-of-the-art frameworks/libraries and tools for developing a web and mobile app. |
| **3** | to infuse skills of combining different components from state-of-the-art technologies to design a web and mobile app to solve real world problems. |

| **Course Outcomes (CO) with Bloom's Taxonomy Level** | | |
|---|---|---|
| **CO1** | summarize the concepts of various state-of-the-art front-end, back-end web and mobile app development technologies & frameworks. | Understanding |
| **CO2** | illustrate the concepts of various state-of-the-art front-end, back-end web and mobile app development technologies & frameworks using different web development tools. | Applying |
| **CO3** | test the concepts and components of various state-of-the-art front-end, back-end web and mobile app development technologies & frameworks using web development tools. | Analysing |
| **CO4** | select appropriate front-end, back-end web and mobile app development technologies, frameworks, tools and their components to solve real-world problems. | Evaluating |
| **CO5** | build a web app and/or mobile app, individually or in a team by combining various state-of-the-art front-end, back-end and/or mobile app development technologies & frameworks for real-world problems. | Creating |

**List of Experiments / Lab Activities**

**Module 1: Web Application Framework/Library – Part 1**
State-of-the-art Front-End Framework library: One of the following technologies will be considered: Angular, React.js or other state-of-the-art front-end development framework/library.
**Experiments:**
1. Installing framework and configuring Integrated Development Environment (IDE), and its dependencies.
2. Creating workspace, project and setting up the necessary environment.
3. Implementing the fundamental syntaxes and components of the framework.
4. Building and testing the application.
5. Deploying the application.

**Module 2: Web Application Framework/Library – Part 2**
State-of-the-art Front-End Framework library: One of the following technologies will be considered: Meteor.js, Vue.js or other state-of-the-art front-end development framework/library.

**Experiments:**

1. Installing framework and configuring Integrated Development Environment (IDE), and its dependencies.
2. Creating workspace, project and setting up the necessary environment.
3. Implementing the fundamental syntaxes and components of the framework.
4. Building and testing the application.
5. Deploying the application.

**Module 3: Server-side Development Framework/Library – Part 1**

State-of-the-art server-side Technology: Ruby on Rails, Flask or other state-of-the-art back-end development framework/library.

**Experiments:**

1. Installing framework and configuring Integrated Development Environment (IDE), and its dependencies.
2. Creating workspace, project and setting up the necessary environment.
3. Implementing the fundamental syntaxes and components of the framework.
4. Implementing server-side validations and authentication for web application.
5. Implementing CRUD operations for web application.
6. Building and testing the application.
7. Deploying the application.

**Module 4: Server-side Development Framework/Library – Part 2**

State-of-the-art server-side Technology: Django or another state-of-the-art framework/library.

**Experiments:**

1. Installing framework and configuring Integrated Development Environment (IDE), and its dependencies.
2. Creating workspace, project and setting up the necessary environment.
3. Implementing the fundamental syntaxes and components of the framework.
4. Implementing server-side validations and authentication for web application.
5. Implementing CRUD operations for web application.
6. Building and testing the application.
7. Deploying the application.

**Module 5: Mobile App Development**

Introduction to App Development, Introduction to Android App Development, Installation and configuration of IDE, Activities, Intents and Intent Filters, UI and Navigation, Camera, Connectivity to database, Web-based content, debugging and testing the app, and publishing the app.

**Experiments:**

1. Installing and configuring Integrated Development Environment (IDE).
2. Managing the project.
3. Writing the app.
4. Connecting the app to the database.
5. Building and running the app on an emulator and on a hardware device.
6. Configuring, debugging, testing, and profiling the app.
7. Publishing the app on the marketplace.

**Module 6: Hosting Web Applications**

Building web application and Hosting web application.

**Experiments:**

1. Choosing a hosting server and selecting a plan for web hosting.
2. Choosing and configuring DNS address.
3. Uploading, configuring and running the website over the internet.

| **Text Books** | |
|---|---|
| 1 | Vasan Subramanian, "Pro MERN Stack: Full Stack Web App Development with Mongo, Express, React, and Node", Apress, 2nd Edition, 2019, ISBN-13: 978-1484243909 |
| 2 | Azat Mardan, "Full Stack JavaScript: Learn Backbone.js, Node.js, and MongoDB", Apress, 2nd Edition, 2018, ISBN-13: 978-1484237175 |
| 3 | Neil Smyth, "Android Studio 3.6 Development Essentials - Java Edition: Developing Android 10 (Q) Apps Using Android Studio 3.6, Java and Android Jetpack", Payload Media, 2020,<br>ISBN-13: 978-1951442156 |
| | |

| | |
|---|---|
| | |
| **References** | |
| 1 | Dawn Griffiths, David Griffiths, “Head First Android Development”, O’Reilly Media, 2nd Edition, 2017, ISBN: 9781491974056 |
| 2 | Rick Boyer, “Android 9 Development Cookbook: Over 100 recipes and solutions to solve the most common problems faced by Android developers”, Packt Publishing Limited, 3rd Edition, 2018, ISBN-13: 978-1788991216 |
| 3 | Felipe Coury, Ari Lerner, Carlos Taborda, “ng-book: The Complete Guide to Angular”, Create Space Independent Publishing Platform, 5th Edition, 2018, ISBN-13: 978-1985170285 |
| | |
| **Useful Links** | |
| 1 | www.w3schools.com |
| 2 | https://developer.android.com/docs |
| 3 | Official framework websites for Documentation/Help |

| **CO-PO Mapping** | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Programme Outcomes (PO)** | | | | | | | | | | | | **PSO** | | |
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | |
| **CO1** | 2 | 1 | | | | | | | | | | | | 1 | |
| **CO2** | 3 | 2 | 2 | 3 | 3 | | | | | | | | | 2 | |
| **CO3** | | 3 | | 2 | 2 | | | | | | | | | 1 | |
| **CO4** | | 2 | | 2 | 3 | | | | | | | | | 1 | |
| **CO5** | | | 3 | 2 | 3 | | | | 3 | | | | | 2 | |
| The strength of mapping is to be written as 1,2,3; Where, 1:Low, 2:Medium, 3:High<br>Each CO of the course must map to at least one PO. | | | | | | | | | | | | | | | |

| **Assessment** | | | | |
|---|---|---|---|---|
| There are three components of lab assessment, LA1, LA2 and Lab ESE.<br>IMP: Lab ESE is a separate head of passing. LA1, LA2 together is treated as In-Semester Evaluation. | | | | |
| **Assessment** | **Based on** | **Conducted by** | **Typical Schedule (for 26-week Sem)** | **Marks** |
| LA1 | Lab activities, attendance, journal | Lab Course Faculty | During Week 1 to Week 6<br>Marks Submission at the end of Week 6 | 30 |
| LA2 | Lab activities, attendance, journal | Lab Course Faculty | During Week 7 to Week 12<br>Marks Submission at the end of Week 12 | 30 |
| Lab ESE | Lab activities, attendance, journal | Lab Course Faculty | During Week 15 to Week 18<br>Marks Submission at the end of Week 18 | 40 |
| Week 1 indicates starting week of a semester. The typical schedule of lab assessments is shown, considering a 26-week semester. The actual schedule shall be as per academic calendar. Lab activities/Lab performance shall include performing experiments, mini-project, presentations, drawings, programming and other suitable activities, as per the nature and requirement of the lab course. The experimental lab shall have typically 8-10 experiments. | | | | |

| **Assessment Plan based on Bloom’s Taxonomy Level (Marks) (For lab Courses)** | | | | |
|---|---|---|---|---|
| **Bloom’s Taxonomy Level** | **LA1** | **LA2** | **Lab ESE** | **Total** |
| Remember | | | | |
| Understand | 5 | 5 | | **10** |
| Apply | 15 | 15 | 15 | **45** |
| Analyse | 5 | 5 | 5 | **15** |
| Evaluate | 5 | 5 | 5 | **15** |
| Create | | | 15 | **15** |
| **Total Marks** | **30** | **30** | **40** | **100** |

| |
|---|
| **Walchand College of Engineering, Sangli**<br>*(Government Aided Autonomous Institute)* |
| **AY 2021-22** |

| **Course Information** | |
|---|---|
| **Programme** | B.Tech. (Computer Science Engineering) |
| **Class, Semester** | Third Year B. Tech., Sem VI |
| **Course Code** | |
| **Course Name** | Software Engineering Tools Laboratory |
| **Desired Requisites:** | Software Engineering SDLC, Project Management, Agile Methodology |

| **Teaching Scheme (Hrs)** | | **Examination Scheme (Marks)** | | | |
|---|---|---|---|---|---|
| **Lecture** | - | **LA1** | **LA2** | **ESE** | **Total** |
| **Tutorial** | - | 30 | 30 | 40 | 100 |
| **Practical** | 2 | | | | |
| **Interaction** | - | **Credits: 1** | | | |

| **Course Objectives** | |
|---|---|
| **1** | To Understand the Software Development dearth and Tools practiced in IT industry. |
| **2** | To Comprehend the hands on exploration of various Software frameworks and CASE tools used on SDLC. |
| **3** | To cognize with the Testing tools to ensure quality assurance. |
| **4** | |

| **Course Outcomes (CO) with Bloom's Taxonomy Level** | | |
|---|---|---|
| At the end of the course, the students will be able to, | | |
| **CO1** | Be familiar with open source software development tools currently used in the industry. | Understand |
| **CO2** | Utilize open source software for developing a variety of software applications, particularly Web applications. | Apply |
| **CO3** | Get acquainted with use of software tools to achieve quality and industry readiness. | Create |

### List of Experiments / Lab Activities

**List of Experiments:**

1. Overview of FOSS.
2. Study of different software development frameworks.
3. Study of project management tools.
4. Understanding version control using VSS.
5. Managing code using SVN.
6. Performing Functional testing
7. Performing regression testing
8. Performing performance testing
9. Study of various software engineering tools.

| **Text Books** | |
|---|---|
| 1 | Dr.K.V.K.K.Prasad, "Software Testing Tools" |
| 2 | Desikan, Ramesh, "Software Testing: principles and Practices", Pearson Education, ISBN |
| 3 | |
| 4 | |

| **References** | |
|---|---|
| 1 | Nina Godbole, "Software Quality Assurance: Principles And Practice", Alpha Science International, Ltd (August 1, 2004) |
| 2 | |

| | |
|---|---|
| 3 | |
| 4 | |
| | |
| **Useful Links** | |
| 1 | https://www.javatpoint.com/software-engineering-case-tools-for-software-metrics |
| 2 | https://www.javatpoint.com/github |
| 3 | https://www.javatpoint.com/software-testing-tutorial |
| 4 | |

| **CO-PO Mapping** | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Programme Outcomes (PO)** | | | | | | | | | | | | **PSO** | | |
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 |
| **CO1** | 2 | 2 | | | | | | | | | | | 1 | | |
| **CO2** | | | | | 2 | | | | | | | | | | |
| **CO3** | | | | 2 | | 2 | | | | | | | | 2 | |
| The strength of mapping is to be written as 1,2,3; Where, 1:Low, 2:Medium, 3:High<br>Each CO of the course must map to at least one PO. | | | | | | | | | | | | | | | |

| **Assessment** | | | | |
|---|---|---|---|---|
| There are three components of lab assessment, LA1, LA2 and Lab ESE.<br>IMP: Lab ESE is a separate head of passing. LA1, LA2 together is treated as In-Semester Evaluation. | | | | |
| **Assessment** | **Based on** | **Conducted by** | **Typical Schedule (for 26-week Sem)** | **Marks** |
| LA1 | Lab activities, attendance, journal | Lab Course Faculty | During Week 1 to Week 6<br>Marks Submission at the end of Week 6 | 30 |
| LA2 | Lab activities, attendance, journal | Lab Course Faculty | During Week 7 to Week 12<br>Marks Submission at the end of Week 12 | 30 |
| Lab ESE | Lab activities, attendance, journal | Lab Course Faculty | During Week 15 to Week 18<br>Marks Submission at the end of Week 18 | 40 |
| Week 1 indicates starting week of a semester. The typical schedule of lab assessments is shown, considering a 26-week semester. The actual schedule shall be as per academic calendar. Lab activities/Lab performance shall include performing experiments, mini-project, presentations, drawings, programming and other suitable activities, as per the nature and requirement of the lab course. The experimental lab shall have typically 8-10 experiments. | | | | |

| **Assessment Plan based on Bloom's Taxonomy Level (Marks) (For lab Courses)** | | | | |
|---|---|---|---|---|
| **Bloom's Taxonomy Level** | **LA1** | **LA2** | **Lab ESE** | **Total** |
| Remember | | | | |
| Understand | 15 | 10 | | **25** |
| Apply | 15 | 10 | 10 | **35** |
| Analyze | | | | |
| Evaluate | | | | |
| Create | | 10 | 30 | **40** |
| **Total Marks** | **30** | **30** | **40** | **100** |

# Walchand College of Engineering, Sangli

*(Government Aided Autonomous Institute)*

## AY 2021-22

| Course Information | |
|---|---|
| **Programme** | B.Tech. (Computer Science and Engineering) |
| **Class, Semester** | Third Year B. Tech., Sem VI |
| **Course Code** | |
| **Course Name** | OE-3 Fundamentals of IOT |
| **Desired Requisites:** | Basic programming knowledge. |

| **Teaching Scheme** | | **Examination Scheme (Marks)** | | | |
|---|---|---|---|---|---|
| **Lecture** | 2 Hrs/week | **Test1** | **Test2** | **ESE** | **Total** |
| **Tutorial** | - | 20 | 20 | 50 | 100 |
| **Practical** | - | | | | |
| **Interaction** | - | **Credits: 2** | | | |

| **Course Objectives** | |
|---|---|
| **1** | To illustrate the basic concepts of Internet of Things. |
| **2** | To illustrate basic concepts of IIOT. |
| **3** | **To demonstrate Working of IOT devices.** |
| **4** | |

| **Course Outcomes (CO) with Bloom's Taxonomy Level** | | |
|---|---|---|
| **CO1** | Explain how to design and develop Applications in IOT. | Apply |
| **CO2** | To Illustrate how IOT devices works | Apply |
| **CO3** | To access different operations using IOT applications. | Evaluate |
| **CO4** | To produce a program to solve a real-world problem. | Create |

| **Module** | **Module Contents** | **Hours** |
|---|---|---|
| I | **Introduction to Internet of Things**<br>Introduction, Physical design of IOT, Logical Design of IOT,IOT Enabling Technology, Sensing, Actuation. | 4 |
| II | **Basics of IOT Networking**<br>Introduction to Networking, IOT Network Protocols, Connectivity Technology | 5 |
| III | **IOT and Communication Protocols**<br>Communication Protocols, Sensor Networks, Machine-to-Machine Communications | 5 |
| IV | **Interoperability in IoT**<br>Introduction to Arduino Programming, Introduction to Python programming, Introduction to Raspberry Pi, Implementation of IoT with Raspberry Pi. | 4 |
| V | **Industrial IoT**<br>Introduction to IIOT,AWS-IOT, Introduction to Lora-wan, Node MCU IOT Platform. | 4 |
| VI | **Case Study**<br>Agriculture, Health care, Smart city, Activity Monitoring, Energy, Environment | 4 |

| **Text Books** | |
|---|---|
| 1 | S. Misra, A. Mukherjee, and A. Roy, 2020. Introduction to IoT. Cambridge University Press. |
| 2 | S. Misra, C. Roy, and A. Mukherjee, 2020. Introduction to Industrial Internet of Things and Industry 4.0. CRC Press. |
| 3 | Research Papers |
| 4 | |

| **References** | |
|---|---|
| 1 | Arashdeep Bahga ,Vijay Madisetti Internet of Things an Hands on Approach,University Press. |

| | |
|---|---|
| 2 | |
| 3 | |
| 4 | |
| | |
| **Useful Links** | |
| 1 | https://onlinecourses.nptel.ac.in/noc21_cs17 |
| 2 | |
| 3 | |
| 4 | |

| **CO-PO Mapping** | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Programme Outcomes (PO)** | | | | | | | | | | | | **PSO** | | |
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 |
| **CO1** | | 2 | 3 | | | | | | | | | | | 2 | |
| **CO2** | 1 | | 2 | | | | | | | | | | | 2 | |
| **CO3** | 1 | 2 | 2 | | | | | | | | | | | 2 | |
| **CO4** | | 2 | 1 | | | | | | | | | | | 1 | |

The strength of mapping is to be written as 1,2,3; Where, 1:Low, 2:Medium, 3:High
Each CO of the course must map to at least one PO.

**Assessment (for Theory Course)**

The assessment is based on 2 in-semester examinations in the form of T1 (Test-1) and T2 (Test-2) of 20 marks each. Also there shall be 1 End-Sem examination (ESE) of 60 marks. T1 shall be typically on modules 1 and 2, T2 based typically on modules 3, 4 and ESE shall be on all modules with nearly 50% weightage on modules 1 to 4 and 50% weightage on modules 5, 6.

Assessment Plan based on Bloom’s Taxonomy Level (Marks) For Theory Course

| **Bloom’s Taxonomy Level** | | **T1** | **T2** | **ESE** | **Total** |
|---|---|---|---|---|---|
| 1 | Remember | | 5 | 5 | 10 |
| 2 | Understand | 5 | 5 | 10 | 20 |
| 3 | Apply | 5 | | 10 | 15 |
| 4 | Analyze | 10 | 5 | 15 | 30 |
| 5 | Evaluate | | 5 | 10 | 15 |
| 6 | Create | | | 10 | 10 |
| **Total** | | **20** | **20** | **60** | **100** |

# Walchand College of Engineering, Sangli

*(Government Aided Autonomous Institute)*

**AY 2021-22**

| **Course Information** | |
|---|---|
| **Programme** | B.Tech. (Computer Science and Engineering) |
| **Class, Semester** | Third Year B. Tech., Sem VI |
| **Course Code** | |
| **Course Name** | Artificial Intelligence and Machine Learning |
| **Desired Requisites:** | Introductory Programming knowledge, Probability and statistics |

| **Teaching Scheme** | | **Examination Scheme (Marks)** | | | |
|---|---|---|---|---|---|
| **Lecture** | 3 Hrs/week | **T1** | **T2** | **ESE** | **Total** |
| **Tutorial** | - | 20 | 20 | 60 | 100 |
| **Practical** | - | | | | |
| **Interaction** | - | **Credits: 3** | | | |

| **Course Objectives** | |
|---|---|
| **1** | Introduce and apply Principles of Artificial Intelligence |
| **2** | Introduce and apply Principles of Machine Learning |

| **Course Outcomes (CO) with Bloom's Taxonomy Level** | | |
|---|---|---|
| **CO1** | Illustrate AI and ML Problems and its simple solutions | Apply |
| **CO2** | Compare simple solutions for AI and ML problems | Analyse |
| **CO3** | Classify various AI and ML problem solving schemes | Evaluate |
| | | |

| **Module** | **Module Contents** | **Hours** |
|---|---|---|
| I | **Introduction to AI and Problem Solving**<br>Introduction, History, Application, Approaches, Problem solving by searching, Constraint satisfaction problems. | 6 |
| II | **Knowledge Representation, Logic and Reasoning**<br>Propositional Logic, Inference rules, First Order Logic, Rule based systems, Reasoning with uncertainty, Fuzzy reasoning, Bayes networks. | 7 |
| III | **Expert Systems**<br>ES Characteristics, Architecture, Rule based ES, Rule Induction, Introduction to Natural Language Processing. | 6 |
| IV | **Introduction to Machine Learning**<br>Introduction to Machine Learning, Concepts of Supervised and Unsupervised Learning, Linear and Multivariate Regression, Dimensionality Reduction. | 7 |
| V | **Bayesian Learning and Decision Trees**<br>Equations, Description, Maximum Likelihood estimate, Decision Trees, examples. | 6 |
| VI | **Evaluation Measures and Hypothesis Testing**<br>Evaluation Measures, ROC curve, Case Study | 6 |

| **Text Books** | |
|---|---|
| 1 | Elaine Rich and Kelvin Knight, Nair, "Artificial Intelligence," McGraw Hill Publication |
| 2 | Janakiraman et al., "Foundations of Artificial Intelligence and Expert Systems", MacMillan India |
| 3 | Tom M. Mitchell, Machine Learning, McGraw-Hill |

| **References** | |
|---|---|
| 1 | NPTEL course on Introduction to AI |
| 2 | NPTEL course on Introduction to ML |

| Useful Links | |
|---|---|
| 1 | Artificial Intelligence Search Methods for Problem Solving (SWAYAM): https://onlinecourses.nptel.ac.in/noc21_cs79/preview |
| 2 | Introduction to Artificial Intelligence (AI) (Coursera): https://www.coursera.org/learn/introduction-to-ai |
| 3 | https://ai.google/education/ |
| 4 | Machine Learning by Stanford (Andrew Ng) on Coursera: https://www.coursera.org/learn/machine-learning |
| 5 | Introduction to Machine Learning – IITM (SWAYAM) https://onlinecourses.nptel.ac.in/noc21_cs70/preview |

| CO-PO Mapping | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Programme Outcomes (PO)** | | | | | | | | | | | | **PSO** | | |
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | |
| **CO1** | 3 | | | | | | | | | | | | 1 | | |
| **CO2** | | 3 | | | | | | | | | | | 1 | | |
| **CO3** | | 3 | | | | | | | | | | | 1 | | |
| | | | | | | | | | | | | | | | |

The strength of mapping is to be written as 1,2,3; Where, 1: Low, 2: Medium, 3: High
Each CO of the course must map to at least one PO.

**Assessment (for Theory Course)**

The assessment is based on 2 in-semester examinations in the form of T1 (Test-1) and T2 (Test-2) of 20 marks each. Also there shall be 1 End-Sem examination (ESE) of 60 marks. T1 shall be typically on modules 1 and 2, T2 based typically on modules 3, 4 and ESE shall be on all modules with nearly 50% weightage on modules 1 to 4 and 50% weightage on modules 5, 6.

**Assessment Plan based on Bloom's Taxonomy Level (Marks) For Theory Course**

| Bloom's Taxonomy Level | | T1 | T2 | ESE | Total |
|---|---|---|---|---|---|
| 1 | Remember | | | | |
| 2 | Understand | | | | |
| 3 | Apply | 15 | 10 | 30 | 55 |
| 4 | Analyze | 5 | 5 | 15 | 25 |
| 5 | Evaluate | | 5 | 15 | 20 |
| 6 | Create | | | | |
| **Total** | | **20** | **20** | **60** | **100** |

# Walchand College of Engineering, Sangli

*(Government Aided Autonomous Institute)*

## AY 2022-23

| Course Information | |
|---|---|
| **Programme** | B.Tech. (Computer Science and Engineering) |
| **Class, Semester** | Final Year B. Tech., Sem VII |
| **Course Code** | 5CS401 |
| **Course Name** | Cryptography and Network Security |
| **Desired Requisites:** | Computer Networks |

| **Teaching Scheme** | | **Examination Scheme (Marks)** | | | |
|---|---|---|---|---|---|
| **Lecture** | 3 Hrs/week | **MSE** | **ISE** | **ESE** | **Total** |
| **Tutorial** | - | 30 | 20 | 50 | 100 |
| | | **Credits: 3** | | | |

| **Course Objectives** | |
|---|---|
| **1** | Understand OSI security architecture and classical encryption techniques. |
| **2** | Acquire fundamental knowledge on the concepts of finite fields and number theory. |
| **3** | Understand various block cipher and stream cipher models. |
| **4** | Describe the principles of public key cryptosystems, hash functions and digital signature. |

**Course Outcomes (CO) with Bloom's Taxonomy Level**

At the end of the course, the students will be able to,

| **CO** | **Course Outcome Statement/s** | **Bloom's Taxonomy Level** | **Bloom's Taxonomy Description** |
|---|---|---|---|
| **CO1** | Apply the number theory concepts to different encryption and decryption techniques to solve problems related to confidentiality and authentication. | III | Apply |
| **CO2** | Analyze security of network protocols and systems | IV | Analyze |
| **CO3** | Justify various methods of authentication and access control for application of technologies to various sections of industry and society. | V | Evaluate |
| **CO4** | Identify and classify security threats and develop a security model to prevent, detect and recover from attack | VI | Create |

| **Module** | **Module Contents** | **Hours** |
|---|---|---|
| I | **INTRODUCTION**<br>Security trends – Legal, Ethical and Professional Aspects of Security, Need for Security at Multiple levels, Security Policies – Model of network security – Security attacks, services and mechanisms – OSI security architecture – Classical encryption techniques: substitution techniques, transposition techniques, steganography- Foundations of modern cryptography: perfect security – information theory – product cryptosystem – cryptanalysis | 8 |
| II | **SYMMETRIC KEY CRYPTOGRAPHY**<br>MATHEMATICS OF SYMMETRIC KEY CRYPTOGRAPHY: Algebraic structures – Modular arithmetic-Euclid"s algorithm- Congruence and matrices SYMMETRIC KEY CIPHERS: Block cipher Principles of DES – Strength of DES – Differential and linear cryptanalysis – Block cipher design principles – Block cipher mode of operation – Evaluation criteria for AES – Advanced Encryption Standard – RC4 | 6 |

| | | |
|---|---|---|
| III | **PUBLIC KEY CRYPTOGRAPHY**<br>MATHEMATICS OF ASYMMETRIC KEY CRYPTOGRAPHY: Primes – Primality Testing –Factorization – Euler‘s totient function, Fermat‘s and Euler‘s Theorem – Chinese Remainder Theorem – Exponentiation and logarithm – ASYMMETRIC KEY CIPHERS: RSA cryptosystem – Key distribution – Key management – Diffie Hellman key exchange -ElGamal cryptosystem –Elliptic curve cryptography. | 6 |
| IV | **MESSAGE AUTHENTICATION AND INTEGRITY**<br>Properties of hash functions, MD2, MD5 and SHA-1, keyed hash functions, attacks on hash functions, Identity and Access Management (IAM), Digital signature– Entity Authentication: Passwords, challenge-response algorithms, zero-knowledge protocols, Authentication applications – Kerberos, X.509. | 6 |
| V | **NETWORK SECURITY**<br>Network security basics: TCP/IP vulnerabilities, Packet Sniffing, ARP spoofing, port scanning, IP spoofing, TCP syn flood, DNS Spoofing, Denial of Service, Internet Security Protocols: SSL/TLS, IPSEC, Email Security: PGP,S/MIME. | 7 |
| VI | **SYSTEM SECURITY**<br>Intruders, IDS, Firewalls, Honey Pots, Software Vulnerabilities, Malicious software – Viruses, Worms, Trojans, Logic Bomb, Bots, Rootkits, Wireless Security, Blockchain Cryptocurrencies and the Dark Web. | 7 |

| | |
|---|---|
| | **Textbooks** |
| 1 | William Stallings, *“Cryptography and Network Security: Principles and Practice”,* Prentice Hall of India. |
| 2 | Behrouz A. Forouzan “*Cryptography And Network Security*”. Tata Mcgraw-Hill, New Delhi India. |
| | **References** |
| 1 | “Applied Cryptography, Protocols Algorithms and Source Code in C”, Bruce Schneier, Wiley. |
| 2 | “Cryptography and Network Security”, Atul Kahate, Tata Mc Graw Hill. |
| 3 | Alfred J. Menezes, Paul C. van Oorschot and Scott A. Vanstone, “Handbook of Applied Cryptography”, CRC Press. |
| 4 | Johannes A. Buchmann, *“Introduction to Cryptography”,* Springer. |
| | **Useful Links** |
| 1 | |

**CO-PO Mapping**

| | **Programme Outcomes (PO)** | | | | | | | | | | | | **PSO** | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| **CO1** | 3 | 3 | | | | | | | | | | | 2 | 2 |
| **CO2** | 3 | 2 | | | | | | | | | | | 3 | 2 |
| **CO3** | 3 | 3 | | | | | | | | | | | 3 | 3 |
| **CO4** | 3 | 2 | | | | | | | | | | | 3 | 1 |

The strength of mapping is to be written as 1: Low, 2: Medium, 3: High
Each CO of the course must map to at least one PO.

**Assessment**

| |
|---|
| The assessment is based on MSE, ISE and ESE.<br>MSE shall be typically on modules 1 to 3.<br>ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO.<br>ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6.<br>For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing) |

| Walchand College of Engineering, Sangli<br>*(Government Aided Autonomous Institute)* | |
|---|---|
| **AY 2022-23** | |
| **Course Information** | |
| **Programme** | B.Tech. (Computer Science and Engineering) |
| **Class, Semester** | Final Year B. Tech., Sem VII |
| **Course Code** | 5CS403 |
| **Course Name** | Humanities 4-Legal, IPR, Safety |
| **Desired Requisites:** | Nil |

| **Teaching Scheme** | | **Examination Scheme (Marks)** | | | |
|---|---|---|---|---|---|
| **Lecture** | 1 Hrs/week | **MSE** | **ISE** | **ESE** | **Total** |
| **Tutorial** | - | 15 | 10 | 25 | 50 |
| | | **Credits: 1** | | | |

| **Course Objectives** | |
|---|---|
| **1** | To introduce the students about Legal, IPR, Safety laws. |
| **2** | To disseminate knowledge on patents, patent regime in India and abroad and registration aspects. |
| **3** | To be aware about current trends in IPR and Govt. steps in fostering IPR. |

**Course Outcomes (CO) with Bloom's Taxonomy Level**

At the end of the course, the students will be able to,

| **CO** | **Course Outcome Statement/s** | **Bloom's Taxonomy Level** | **Bloom's Taxonomy Description** |
|---|---|---|---|
| **CO1** | Understand about Indian industry Legal, IPR, Safety laws. | II | Understanding |
| **CO2** | Interpret patent and copyright in innovative research work. | III | Applying |
| **CO3** | Illustrate the importance of Indian industry Legal, IPR, Safety laws | IV | Analyzing |

| **Module** | **Module Contents** | **Hours** |
|---|---|---|
| I | Overview of Bureau of Indian Standards Act of 1986 | 2 |
| II | The Right to Information Act of 2005, In order to promote public education and public safety. | 2 |
| III | Intellectual Property, Patents, Copyrights, Trademarks. | 3 |
| IV | Other forms of IP, Current Contour. | 2 |
| V | Information technology Act 2008,Cyber laws. | 3 |
| VI | IT Laws and Regulations in Connection with IPR. | 1 |

| **Textbooks** | |
|---|---|
| 1 | Nithyananda, K V. (2019). Intellectual Property Rights: Protection and Management. India, IN:Cengage Learning India Private Limited. |
| 2 | Cyber Law by Duggal Pavan |

| **References** | |
|---|---|
| 1 | Ahuja, V K. (2017). Law relating to Intellectual Property Rights. India, IN: Lexis Nexis. |

| **Useful Links** | |
|---|---|
| 1 | Cell for IPR Promotion and Management (http://cipam.gov.in/) |
| 2 | https://law.resource.org/pub/in/bis/manifest.med.html |
| 3 | World Intellectual Property Organization (https://www.wipo.int/about-ip/en/) |
| 4 | Office of the Controller General of Patents, Designs & Trademarks (http://www.ipindia.nic.in/) |

| CO-PO Mapping | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Programme Outcomes (PO)** | | | | | | | | | | | **PSO** | |
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| **CO1** | | | | | | | | 1 | | | | | 1 | 1 |
| **CO2** | | | | | | | | | 2 | | | | 1 | 1 |
| **CO3** | | | | | | | 1 | | | | | | 2 | 1 |
| The strength of mapping is to be written as 1: Low, 2: Medium, 3: High<br>Each CO of the course must map to at least one PO. | | | | | | | | | | | | | | |

| Assessment |
|---|
| The assessment is based on MSE, ISE and ESE.<br>MSE shall be typically on modules 1 to 3.<br>ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO.<br>ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6.<br>For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing) |

# Walchand College of Engineering, Sangli

*(Government Aided Autonomous Institute)*

**AY 2022-23**

**Course Information**

| | |
|---|---|
| **Programme** | B.Tech. (Computer Science and Engineering) |
| **Class, Semester** | Final Year B. Tech., Sem VII |
| **Course Code** | 5CS453 |
| **Course Name** | Cryptography and Network Security Lab |
| **Desired Requisites:** | Computer Networking |

| **Teaching Scheme** | | **Examination Scheme (Marks)** | | | |
|---|---|---|---|---|---|
| **Practical** | 2 Hrs/ Week | **LA1** | **LA2** | **Lab ESE** | **Total** |
| **Interaction** | - | 30 | 30 | 40 | 100 |
| | | **Credits: 1** | | | |

**Course Objectives**

| | |
|---|---|
| **1** | To learn different cipher techniques |
| **2** | To implement the algorithms DES, AES, RSA,MD5,SHA-1 |
| **3** | To use network security tools and vulnerability assessment tools |

**Course Outcomes (CO) with Bloom's Taxonomy Level**

At the end of the course, the students will be able to,

| **CO** | **Course Outcome Statement/s** | **Bloom's Taxonomy Level** | **Bloom's Taxonomy Description** |
|---|---|---|---|
| **CO1** | Develop code for classical Encryption Techniques to solve the real life problems | III | Apply |
| **CO2** | Analyze the network security system using open source tools | IV | Analyze |
| **CO3** | Evaluate the securities of different security protocols | V | Evaluate |
| **CO4** | Build cryptosystems by applying symmetric and public key encryption algorithms | VI | Create |

**List of Experiments / Lab Activities/Topics**

**List of Topics(Applicable for Interaction mode ):**

**List of Lab Activities:**

1. Perform encryption, decryption using the following substitution techniques
   a. Ceaser cipher,
   b. playfair cipher
   c. Hill Cipher
   d. Vigenere cipher
2. Perform encryption and decryption using following transposition techniques
   a. Rail fence
   b. row and Column Transformation
3. Implementation of Euclidean and Extended Euclidean Algorithm
4. Implementation of Chinese Remainder Theorem (CRT)
5. Apply DES algorithm for practical applications
6. Apply AES algorithm for practical applications
7. Implementation of RSA Algorithm
8. Implement the Diffie-Hellman Key Exchange algorithm for a given problem
9. Calculate the message digest of a text using the SHA-1 algorithm
10. Implement the SIGNATURE SCHEME – Digital Signature Standard
11. Demonstration of SSL using Wireshark
12. Automated Attack and Penetration Tools
    Exploring a Vulnerability Assessment Tool

In case of mini-projects, drawing, presentations etc, write the relevant details of the same.

| Textbooks | |
|---|---|
| 1 | William Stallings, *"Cryptography and Network Security: Principles and Practice",* Prentice Hall of India. |
| 2 | Behrouz A. Forouzan "*Cryptography And Network Security*". Tata Mcgraw-Hill, New Delhi India. |

| References | |
|---|---|
| 1 | "Applied Cryptography, Protocols Algorithms and Source Code in C", Bruce Schneier, Wiley. |
| 2 | "Cryptography and Network Security", Atul Kahate, Tata Mc Graw Hill. |

| Useful Links | |
|---|---|
| 1 | |

| CO-PO Mapping | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Programme Outcomes (PO) | | | | | | | | | | | | PSO | |
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| **CO1** | 3 | | | | | | | | | | | | 3 | 2 |
| **CO2** | 3 | 3 | | | 3 | | | | | | | | 3 | 1 |
| **CO3** | 3 | 3 | | 2 | | | | | | | | | 3 | 2 |
| **CO4** | 3 | 2 | | | | | | | | | | | 3 | 2 |
| The strength of mapping is to be written as 1,2,3; where, 1: Low, 2: Medium, 3: High<br>Each CO of the course must map to at least one PO, and preferably to only one PO. | | | | | | | | | | | | | | |

**Assessment**

| There are three components of lab assessment, LA1, LA2 and Lab ESE.<br>IMP: Lab ESE is a separate head of passing.(min 40 %), LA1+LA2 should be min 40% | | | | |
|---|---|---|---|---|
| **Assessment** | **Based on** | **Conducted by** | **Typical Schedule** | **Marks** |
| LA1 | Lab activities, attendance, journal | Lab Course Faculty | During Week 1 to Week 8<br>Marks Submission at the end of Week 8 | 30 |
| LA2 | Lab activities, attendance, journal | Lab Course Faculty | During Week 9 to Week 16<br>Marks Submission at the end of Week 16 | 30 |
| Lab ESE | Lab activities, journal/ performance | Lab Course Faculty and External Examiner as applicable | During Week 18 to Week 19<br>Marks Submission at the end of Week 19 | 40 |
| Week 1 indicates starting week of a semester. Lab activities/Lab performance shall include performing experiments, mini-project, presentations, drawings, programming, and other suitable activities, as per the nature and requirement of the lab course. The experimental lab shall have typically 8-10 experiments and related activities if any. | | | | |

# Walchand College of Engineering, Sangli

*(Government Aided Autonomous Institute)*

**AY 2022-23**

| Course Information | |
|---|---|
| **Programme** | B.Tech. (Computer science and engineering) |
| **Class, Semester** | Final Year B. Tech., Sem VII |
| **Course Code** | 5CS454 |
| **Course Name** | Techno-Socio Activity |
| **Desired Requisites:** | This is the audit course. No pre-requisite |

| **Teaching Scheme** | | **Examination Scheme (Marks)** | | | |
|---|---|---|---|---|---|
| **Practical** | - | **LA1** | **LA2** | **ESE** | **Total** |
| **Interaction** | 1 Hrs/ Week | 15 | 15 | 20 | 50 |
| | | **Credits: 1** | | | |

| **Course Objectives** | |
|---|---|
| **1** | To nurture technical knowledge mainly through various participations and competitions during their engineering study |
| **2** | To develop empathy by participating in social empowerment acts |

**Course Outcomes (CO) with Bloom's Taxonomy Level**

At the end of the course, the students will be able to,

| **CO** | **Course Outcome Statement/s** | **Bloom's Taxonomy Level** | **Bloom's Taxonomy Description** |
|---|---|---|---|
| **CO1** | To develop professional and soft skills to participations | IV | Analyse |
| **CO2** | To analyse real world problem, create and showcase the best solution of techno-socio domains | VI | Create |

**List of Experiments / Lab Activities/Topics**

**List of Topics(Applicable for Interaction mode ):**

**List of Lab Activities:**

Open to students. Student can undertake any techno-socio activity as listed below but not limited to it :

1. Each student or group of students may participate in any social activity like "Swach Bharat Abhiyan",
2. "Blood Donation Camp", or any social activity announced by Govt. / Corporation / Panchayat. Each student or group of students participating in technical events / competition.
3. Awards / recognition received in techno-socio activity
4. Completing the on line courses (on topics beyond syllabus) / certification of any companies / technologies (e.g. IBM / Oracle / CISCO etc.)
5. Developing any innovative gadget / solution / system and transfer in the interest of Nation / Society / Institute (WCE)
6. Published a papers in national / international conferences / journals
7. Coordinating the students clubs / services
8. Organizing techno-socio activity for the students / community in rural areas, backward areas.

| **Textbooks** | |
|---|---|
| 1 | Nil |

| **References** | |
|---|---|
| 1 | The students may refer/undergo on line courses required to undertake any techno-socio activity. |

| **Useful Links** | |
|---|---|
| 1 | Nil |

| CO-PO Mapping | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Programme Outcomes (PO) | | | | | | | | | | | | PSO | |
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| **CO1** | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 1 | -- | -- | -- |
| **CO2** | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 2 | -- | -- | -- |
| **CO3** | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| The strength of mapping is to be written as 1,2,3; where, 1: Low, 2: Medium, 3: High<br>Each CO of the course must map to at least one PO, and preferably to only one PO. | | | | | | | | | | | | | | |

| Assessment | | | | |
|---|---|---|---|---|
| There are three components of lab assessment, LA1, LA2 and Lab ESE.<br>IMP: Lab ESE is a separate head of passing.(min 40 %), LA1+LA2 should be min 40% | | | | |
| **Assessment** | **Based on** | **Conducted by** | **Typical Schedule** | **Marks** |
| LA1 | Lab activities, attendance, journal | Lab Course Faculty | During Week 1 to Week 8<br>Marks Submission at the end of Week 8 | 15 |
| LA2 | Lab activities, attendance, journal | Lab Course Faculty | During Week 9 to Week 16<br>Marks Submission at the end of Week 16 | 15 |
| Lab ESE | Lab activities, journal/ performance | Lab Course Faculty and External Examiner as applicable | During Week 18 to Week 19<br>Marks Submission at the end of Week 19 | 20 |
| Week 1 indicates starting week of a semester. Lab activities/Lab performance shall include performing experiments, mini-project, presentations, drawings, programming, and other suitable activities, as per the nature and requirement of the lab course. The experimental lab shall have typically 8-10 experiments and related activities if any. | | | | |

# Walchand College of Engineering, Sangli

*(Government Aided Autonomous Institute)*

## AY 2022-23

### Course Information

| | |
|---|---|
| **Programme** | B.Tech. (Computer science and engineering) |
| **Class, Semester** | Final Year B. Tech., Sem VII |
| **Course Code** | 5CS491 |
| **Course Name** | Project-1 |
| **Desired Requisites:** | Nil |

| **Teaching Scheme** | | **Examination Scheme (Marks)** | | | |
|---|---|---|---|---|---|
| **Practical** | 6 Hrs/ Week | **LA1** | **LA2** | **Lab ESE** | **Total** |
| **Interaction** | - | 30 | 30 | 40 | 100 |
| | | **Credits: 3** | | | |

### Course Objectives

| | |
|---|---|
| **1** | To understand Software Development Life Cycle and prepare project proposal based on real life use case |
| **2** | To utilize state of the art CASE tools especially for design, development and testing phases. |
| **3** | To experience project management techniques. |
| **4** | To acquaint the ability to map technical skills to real life applications from customers perspective. |

### Course Outcomes (CO) with Bloom's Taxonomy Level

At the end of the course, the students will be able to,

| **CO** | **Course Outcome Statement/s** | **Bloom's Taxonomy Level** | **Bloom's Taxonomy Description** |
|---|---|---|---|
| **CO1** | demonstrate the state-of-art technological trends through planning and design project aspects. | II | Understanding |
| **CO2** | adopt agile methodology and mature team skills through various SDLC phases. | III | Applying |
| **CO3** | showcase the project working model with real life use case mainly to potential customers. | VI | Creating |

### List of Experiments / Lab Activities/Topics

**List of Topics(Applicable for Interaction mode ):**

**List of Lab Activities:**

1. Project work is to be carried out in two semesters with group size of maximum three to four students
2. In first semester project group will select a project topic with consent from guide and approval from department and submit the brief document discussing the outline of the project with clear objectives.
3. Students should maintain a project log book containing weekly progress of the project.
4. At the end of the semester project group should complete the system design, Algorithm design and present with suitable model. (CFD, DFD & Data structure layout, SRS & UML diagram using project management tool)
5. Project report should be prepared using Latex and submitted in soft and hard form.

### Textbooks

| | |
|---|---|
| 1 | Nil |

### References

| | |
|---|---|
| 1 | Nil |

### Useful Links

| | |
|---|---|
| 1 | Nil |

| CO-PO Mapping | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Programme Outcomes (PO) | | | | | | | | | | | | PSO | |
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| **CO1** | -- | 3 | -- | 2 | -- | -- | -- | -- | 1 | -- | -- | -- | -- | -- |
| **CO2** | -- | -- | 3 | -- | -- | -- | -- | -- | -- | 1 | -- | -- | -- | -- |
| **CO3** | -- | -- | -- | 3 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| The strength of mapping is to be written as 1,2,3; where, 1: Low, 2: Medium, 3: High<br>Each CO of the course must map to at least one PO, and preferably to only one PO. | | | | | | | | | | | | | | |

| Assessment | | | | |
|---|---|---|---|---|
| There are three components of lab assessment, LA1, LA2 and Lab ESE.<br>IMP: Lab ESE is a separate head of passing.(min 40 %), LA1+LA2 should be min 40% | | | | |
| **Assessment** | **Based on** | **Conducted by** | **Typical Schedule** | **Marks** |
| LA1 | Lab activities, attendance, journal | Lab Course Faculty | During Week 1 to Week 8<br>Marks Submission at the end of Week 8 | 30 |
| LA2 | Lab activities, attendance, journal | Lab Course Faculty | During Week 9 to Week 16<br>Marks Submission at the end of Week 16 | 30 |
| Lab ESE | Lab activities, journal/ performance | Lab Course Faculty and External Examiner as applicable | During Week 18 to Week 19<br>Marks Submission at the end of Week 19 | 40 |
| Week 1 indicates starting week of a semester. Lab activities/Lab performance shall include performing experiments, mini-project, presentations, drawings, programming, and other suitable activities, as per the nature and requirement of the lab course. The experimental lab shall have typically 8-10 experiments and related activities if any. | | | | |

# Walchand College of Engineering, Sangli

*(Government Aided Autonomous Institute)*

## AY 2022-23

| Course Information | |
|---|---|
| **Programme** | B.Tech. (Computer Science Engineering) |
| **Class, Semester** | Final Year B. Tech., Sem VII |
| **Course Code** | 5CS455 |
| **Course Name** | Humanities 3-Project Management |
| **Desired Requisites:** | Software Engineering |

| **Teaching Scheme** | | **Examination Scheme (Marks)** | | | |
|---|---|---|---|---|---|
| **Practical** | - | **LA1** | **LA2** | **ESE** | **Total** |
| **Interaction** | 1 Hrs/ Week | 15 | 15 | 20 | 50 |
| | | **Credits: 1** | | | |

| **Course Objectives** | |
|---|---|
| **1** | To provide in-depth coverage of project management principles using tools. |
| **2** | To Understand the Project management tools practiced in the IT industry. |
| **3** | To Comprehend the hands-on exploration of project management tools used on Software Development. |

**Course Outcomes (CO) with Bloom's Taxonomy Level**

At the end of the course, the students will be able to,

| **CO** | **Course Outcome Statement/s** | **Bloom's Taxonomy Level** | **Bloom's Taxonomy Description** |
|---|---|---|---|
| **CO1** | Be familiar with project management concepts used in software development in industry. | II | Understanding |
| **CO2** | Utilize project management tools for developing a variety of software applications. | III | Applying |
| **CO3** | Get acquainted with the use of project management tools to achieve quality and industry readiness. | VI | Creating |

**List of Experiments / Lab Activities/Topics**

**List of Topics(Applicable for Interaction mode ):**

**List of Lab Activities:**

1. Overview of Jira software.
2. Study of Project management using Jira.
3. Understanding Workflow management.
4. Managing Tasks using Jira.
5. Jira user and role management.
6. Project Monitoring and Reporting.
7. Issue management using.
8. Bug tracking and reporting.
9. Performing Project Integration.
10. Agile best practices using Jira.
11. Version management using Jira.

| **Textbooks** | |
|---|---|
| 1 | Jira Project Management A Complete Guide - 2019 by Gerardus Blokdyk . The Art of Service |
| 2 | Jira Quick Start Guide: Manage your projects efficiently using the all-new Jira by Ravi Sagar |

| **References** | |
|---|---|
| 1 | JIRA Essentials, Third Edition, Patrick Li,Packt enterprise |

| | |
|---|---|
| | |
| **Useful Links** | |
| 1 | https://www.atlassian.com/ |
| 2 | https://www.javatpoint.com/jira-tutorial |

| **CO-PO Mapping** | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Programme Outcomes (PO)** | | | | | | | | | | | | **PSO** | |
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| **CO1** | 2 | 2 | | | | | | | | | | | 2 | |
| **CO2** | | | | | 3 | | | | | | | | | |
| **CO3** | | | | 2 | | 2 | | | | | | | | 2 |
| The strength of mapping is to be written as 1,2,3; where, 1: Low, 2: Medium, 3: High<br>Each CO of the course must map to at least one PO, and preferably to only one PO. | | | | | | | | | | | | | | |

| **Assessment** | | | | |
|---|---|---|---|---|
| There are three components of lab assessment, LA1, LA2 and Lab ESE.<br>IMP: Lab ESE is a separate head of passing.(min 40 %), LA1+LA2 should be min 40% | | | | |
| **Assessment** | **Based on** | **Conducted by** | **Typical Schedule** | **Marks** |
| LA1 | Lab activities, attendance, journal | Lab Course Faculty | During Week 1 to Week 8<br>Marks Submission at the end of Week 8 | 30 |
| LA2 | Lab activities, attendance, journal | Lab Course Faculty | During Week 9 to Week 16<br>Marks Submission at the end of Week 16 | 30 |
| Lab ESE | Lab activities, journal/ performance | Lab Course Faculty and External Examiner as applicable | During Week 18 to Week 19<br>Marks Submission at the end of Week 19 | 40 |
| Week 1 indicates starting week of a semester. Lab activities/Lab performance shall include performing experiments, mini-project, presentations, drawings, programming, and other suitable activities, as per the nature and requirement of the lab course. The experimental lab shall have typically 8-10 experiments and related activities if any. | | | | |

# Walchand College of Engineering, Sangli

*(Government Aided Autonomous Institute)*

**AY 2022-23**

| Course Information | |
|---|---|
| **Programme** | B.Tech. (Computer Science and Engineering) |
| **Class, Semester** | Final Year B. Tech., Sem VII |
| **Course Code** | 5CS411 |
| **Course Name** | Elective-5: High Performance Computing |
| **Desired Requisites:** | Data structures, Basic Programming knowledge |

| **Teaching Scheme** | | **Examination Scheme (Marks)** | | | |
|---|---|---|---|---|---|
| **Lecture** | 3 Hrs/week | **MSE** | **ISE** | **ESE** | **Total** |
| **Tutorial** | - | 30 | 20 | 50 | 100 |
| | | **Credits: 3** | | | |

**Course Objectives**

| | |
|---|---|
| **1** | To be introduced with current trends in parallel computer architectures and programming models (i.e. languages and libraries) for shared memory, many core/multicore architecture. |
| **2** | To understand parallel program design methodology. Also to calculate speedup and efficiency of parallel algorithm. |
| **3** | To learn various parallel algorithms for matrices, graphs. |

**Course Outcomes (CO) with Bloom's Taxonomy Level**

At the end of the course, the students will be able to,

| **CO** | **Course Outcome Statement/s** | **Bloom's Taxonomy Level** | **Bloom's Taxonomy Description** |
|---|---|---|---|
| **CO1** | Describe different parallel paradigms, inter connection networks, and tools for parallel programming. | II | Understand |
| **CO2** | Demonstrate design methodology and performance measurement of parallel algorithms on various parallel platforms. | III | Apply |
| **CO3** | Analyze a given problem for possibilities of parallel computations. | IV | Analyze |

| **Module** | **Module Contents** | **Hours** |
|---|---|---|
| I | **Introduction**<br>What is parallel computing? The scope of parallel computing? Issues in parallel computing. Taxonomy of parallel architecture, Memory bound vs Compute bound problems, Dynamic interconnection networks, static interconnection networks, Routing mechanism for static network. Communication cost in static interconnection network. | 8 |
| II | **Parallel programming models and paradigms**<br>Introduction, parallel applications and development, code granularity and level of parallelism, parallel programming models and tools, methodical design of parallel algorithm, parallel program paradigm, programming skeleton and templates. | 6 |
| III | **Performance and scalability of parallel systems**<br>Performance Metrics for parallel systems. The effect of Granularity and Data Mapping on Performance. The Scalability of parallel systems, Isoefficiency metric of scalability, sources of parallel overhead, Minimum execution time and minimum cost-optimal execution time, parallel work efficiency, amdahl limiters, communication-computation overlap/pipelining. | 8 |

| | | |
|---|---|---|
| IV | **Parallel programming libraries**<br>OpenMP, MPI, Thread basics ,Work Sharing constructs, Scheduling, Reduction, Mutual Exclusion Synchronization & Barriers, The MPI Programming Model, MPI Basics, Global Operations , Asynchronous Communication, Modularity, Other MPI Features, Performance Issues, Thread programming C++11 Threads /OpenMP, MPI - two sided communication, one side communication based programming model aka PGAS (Partitioned Global Address Space) eg: OpenSHMEM/NVSHMEM. | 6 |
| V | **Parallel programming using accelerators**<br>Introduction of CUDA/OpenCL, Chapel, etc. Basics of GPGPU, CUDA Programming model, CUDA memory type, CUDA and/or OpenCL for GPGPU hardware, case study. | 6 |
| VI | **Algorithms**<br>Dense matrix algorithms, sorting, graph algorithms, prefix sum with decoupled lookback, parallel radix sort/batcher's sort | 6 |

| **Textbooks** | |
|---|---|
| 1 | "Introduction to Parallel Computing", (2nd ed.), by Ananth Grama, Anshul Gupta, George Karypis, and Vipin Kumar. |
| 2 | "High Performance Cluster Computing : Programming and Applications", Volume 2 By Buyya Rajkumar. |
| 3 | "CUDA Programming: A Developer's Guide to Parallel Computing with GPUs", by Shane cook "Introduction to PARALLEL PROGRAMMING", by Peter Pacheco. |

| **References** | |
|---|---|
| 1 | "Parallel Programming in C with MPI and OpenMP", Michael J. Quinn, McGraw-Hill, 2004. |

| **Useful Links** | |
|---|---|
| 1 | Single-pass Parallel Prefix Scan with Decoupled Look-back https://research.nvidia.com/publication/single-pass-parallel-prefix-scan-decoupled-look-back |
| 2 | parallel radix sort/batcher's sort. https://developer.download.nvidia.com/video/gputechconf/gtc/2020/presentations/s21572-a-faster-radix-sort-implementation.pdf |
| 3 | High Performance Computing, Charles Severance, 1998. http://cnx.org/content/col11136/latest/ |
| 4 | MPI: The Complete Reference, Marc Snir, Steve Otto, Steven Huss-Lederman, David Walker, and Jack Dongarra, 1996. http://www.netlib.org/utk/papers/mpi-book/mpi-book.html |

**CO-PO Mapping**

| | **Programme Outcomes (PO)** | | | | | | | | | | | | **PSO** | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| **CO1** | 2 | | | | | | | | | | | | 1 | 1 |
| **CO2** | | 3 | | | | | | | | | | | 3 | 1 |
| **CO3** | | 2 | 2 | | | | | | | | | | 2 | 1 |

The strength of mapping is to be written as 1: Low, 2: Medium, 3: High
Each CO of the course must map to at least one PO.

**Assessment**

| |
|---|
| The assessment is based on MSE, ISE and ESE.<br>MSE shall be typically on modules 1 to 3.<br>ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO.<br>ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6.<br>For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing) |

# Walchand College of Engineering, Sangli

*(Government Aided Autonomous Institute)*

## AY 2022-23

| Course Information | |
|---|---|
| **Programme** | B.Tech. (Computer Science and Engineering) |
| **Class, Semester** | Final Year B. Tech., Sem VII |
| **Course Code** | 5CS412 |
| **Course Name** | Elective-5 : Data Mining |
| **Desired Requisites:** | Database Engineering |

| **Teaching Scheme** | | **Examination Scheme (Marks)** | | | |
|---|---|---|---|---|---|
| **Lecture** | 3 Hrs/week | **MSE** | **ISE** | **ESE** | **Total** |
| **Tutorial** | - | 30 | 20 | 50 | 100 |
| | | **Credits: 3** | | | |

| **Course Objectives** | |
|---|---|
| **1** | To gain the knowledge of theoretical background to several of the commonly used data mining techniques. |
| **2** | To analyze data, choose relevant models and algorithms for respective applications. |
| **3** | To evaluate the different data mining algorithms and tools |
| **4** | To develop research interest towards advances in data mining |

**Course Outcomes (CO) with Bloom's Taxonomy Level**

At the end of the course, the students will be able to,

| **CO** | **Course Outcome Statement/s** | **Bloom's Taxonomy Level** | **Bloom's Taxonomy Description** |
|---|---|---|---|
| **CO1** | **apply** the data pre-processing and data mining algorithms to **solve** real world problems | III | Apply |
| **CO2** | **analyze** a complex data mining problem and different data mining algorithms to **identify** solutions. | IV | Analyze |
| **CO3** | **measure** the performance of different data mining algorithms/tools, **evaluate** and **recommend** the optimal solution. | V | Evaluate |
| **CO4** | **Design** and **build** a data mining tool/solution to meet the given set of computing requirements in the context of the complex data mining problem. | VI | Create |

| **Module** | **Module Contents** | **Hours** |
|---|---|---|
| I | **Introduction**<br>Data mining and its need, Different kinds of data that can be mined, Various patterns that can be mined, Technologies to be Used, Target applications, Major Issues in Data Mining. | 5 |
| II | **About Data and its pre-processing**<br>Data objects and attribute types, basic statistical description of data, Data visualization, Data pre-processing : Overview, data cleaning, data integration, data transformation and data discretization. | 7 |
| III | **Classification**<br>Basic concepts, decision tree induction and rule based classification, Bayes Classification, Artificial Neural Network (ANN) based classification, Metrics for Evaluating Classifier Performance | 8 |
| IV | **Clustering**<br>Basic concepts, measuring data similarity and dissimilarity, partitioning methods, Hierarchical Methods, Density-Based methods, Evaluation of Clustering | 6 |

| | | |
|---|---|---|
| V | **Association Rule Mining**<br>Basic concepts, Frequent itemset mining methods, interesting patterns and its evaluation methods, Pattern Exploration and Application. | 6 |
| VI | **Web Mining**<br>Introduction, web content mining, web structure mining, web usage mining | 7 |

| **Textbooks** | |
|---|---|
| 1 | Jiawei Han , Micheline Kamber and Jian Pei , *"Data Mining - Concepts and Techniques"* , Third Edition, Morgan Kaufmann, 2012, ISBN 978-0-12-381479-1 |
| 2 | Dunham, Margaret H , *"Data Mining: Introductory and Advanced Topics"*, 1$^{st}$ Edition , PHI/Pearson, 2006 , ISBN 978-81-7758-785-2 |

| **References** | |
|---|---|
| 1 | Sumathi, S., Sivanandam, S.N. , *"Introduction to Data Mining and its Applications"*, Springer , 2006 , ISBN 978-3-540-34351-6 |
| 2 | P. Tan, M. Steinbach and V. Kumar, *"Introduction to Data Mining"*, 2$^{nd}$ Edition, Addison Wesley, 2019, |
| 3 | Related papers from various IEEE Transactions , Int. Journals / Conferences. |

| **Useful Links** | |
|---|---|
| 1 | Data sets : https://archive.ics.uci.edu/ml/index.php |
| 2 | IEEE Transactions on Knowledge and Data Engineering : https://ieeexplore.ieee.org/xpl/RecentIssue.jsp?punumber=69 |
| 3 | Tools - Tableau : https://www.tableau.com/developer/tools , SPSS : https://www.ibm.com/in-en/analytics/spss-statistics-software , Weka : https://www.cs.waikato.ac.nz/ml/weka/ |
| 4 | Data Mining Resources : https://www.cs.purdue.edu/homes/ayg/CS590D/resources.html |

**CO-PO Mapping**

| | **Programme Outcomes (PO)** | | | | | | | | | | | | **PSO** | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| **CO1** | 2 | | | | | | | | | | | | 2 | |
| **CO2** | | 3 | | | | | | | | | | | | 2 |
| **CO3** | | | | 3 | | | | | | | | | 3 | |
| **CO4** | | | 3 | | | | | | | | | | | 3 |

The strength of mapping is to be written as 1: Low, 2: Medium, 3: High
Each CO of the course must map to at least one PO.

**Assessment**

The assessment is based on MSE, ISE and ESE.
MSE shall be typically on modules 1 to 3.
ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO.
ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6.
For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

## Walchand College of Engineering, Sangli

*(Government Aided Autonomous Institute)*

### AY 2022-23

| Course Information | |
|---|---|
| **Programme** | B.Tech. (Computer Science & Engineering) |
| **Class, Semester** | Final Year B. Tech., Sem VII |
| **Course Code** | 5CS413 |
| **Course Name** | Elective 6: Software Defined Network |
| **Desired Requisites:** | Computer Network and Data Communication |

| **Teaching Scheme** | | **Examination Scheme (Marks)** | | | |
|---|---|---|---|---|---|
| **Lecture** | 3 Hrs/week | **MSE** | **ISE** | **ESE** | **Total** |
| **Tutorial** | - | 30 | 20 | 50 | 100 |
| | | **Credits: 3** | | | |

| **Course Objectives** | |
|---|---|
| **1** | To understand SDN/NFV motivation and benefits. |
| **2** | To describe how SDN/Openflow work. |
| **3** | To understand mininet and some programming languages. |

**Course Outcomes (CO) with Bloom's Taxonomy Level**

At the end of the course, the students will be able to,

| **CO** | **Course Outcome Statement/s** | **Bloom's Taxonomy Level** | **Bloom's Taxonomy Description** |
|---|---|---|---|
| **CO1** | understand OpenFlow, challenges in SDN, and the recent development in SDN | II | Understanding |
| **CO2** | Analyse and apply implementation of SDN through Open Flow Switches, SDN-Controllers. | IV, III | Analysing, Applying |
| **CO3** | Evaluate the pros and cons of applying SDN, API approaches, Hypervisor overlays, and SDN Data Centre | V | Evaluating |

| **Module** | **Module Contents** | **Hours** |
|---|---|---|
| I | **History and Evolution of Software Defined Networking (SDN)**<br>Introduction, Traditional Vs. SDN network, Separation of Control Plane and Data Plane, IETF Forces, Active Networking. Control and Data Plane Separation: Concepts, Advantages and Disadvantages. | 8 |
| II | **OpenFlow Protocol and Network Virtualization**<br>Introduction to OpenFlow Protocol, OpenFlow Versions, OpenFlow with multiple flow tables, Virtualization: Concepts, Applications of virtual networking, Existing Network Virtualization Framework (VMWare and others), Open Virtual Switch (OVS), OpenFlow flow entries on OVS, Monitoring tools: Mininet, OpenDaylight, etc., Mininet introduction, Network virtualization with mininet and Mininet topologies. | 7 |
| III | **Control Plane**<br>Overview, Existing SDN Controllers including Floodlight and Open Daylight projects. Customization of Control Plane: Switching and Firewall, Implementation using SDN Concepts. | 6 |
| IV | **Data Plane**<br>Software-based and Hardware-based; Programmable Network Hardware. Programming SDNs: Northbound Application Programming Interface, Current Languages and Tools, Composition of SDNs. | 6 |
| V | **Network Functions Virtualization (NFV) and Software Defined Networks**<br>Network architecture, NFV Infrastructure, NFV Management and Orchestration (MANO), NFV and SDN | 5 |

| | | |
|---|---|---|
| VI | **Data Centre Networks**<br>Packet, Optical and Wireless Architectures, Network Topologies.<br>Use Cases of SDNs: Data Centres, Internet Exchange Points, Backbone Networks, Home Networks, Traffic Engineering. | 7 |

| | |
|---|---|
| **Textbooks** | |
| 1 | SDN: Software Defined Networks, an Authoritative Review of Network Programmability Technologies, By Thomas D. Nadeau, Ken Gray Publisher: O'Reilly Media, August 2013, ISBN: 978-1-4493-4230-2, ISBN 10:1-4493-4230-2. |
| 2 | Software Defined Networks: A Comprehensive Approach, by Paul Goransson and Chuck Black, Morgan Kaufmann, June 2014, Print Book ISBN: 9780124166752, eBook ISBN : 9780124166844 |
| **References** | |
| 1 | SDN and OpenFlow for Beginners by Vivek Tiwari, Sold by: Amazon Digital Services, Inc., ASIN: , 2013. |
| 2 | Network Innovation through OpenFlow and SDN: Principles and Design, Edited by Fei Hu, CRC Press, ISBN-10: 1466572094, 2014 |
| 3 | sdnhub.org |
| **Useful Links** | |
| 1 | https://www.youtube.com/watch?v=dkUDUb9GtH0&list=PLpherdrLyny8YN4M24iRJBMCXkLcGbmhY&ab_channel=NickFeamster |

**CO-PO Mapping**

| | Programme Outcomes (PO) | | | | | | | | | | | | PSO | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| **CO1** | | 2 | | | 3 | | | | | | | 1 | | |
| **CO2** | | | | | 3 | | | | | | | 2 | | |
| **CO3** | | | | | | | | | | | | 2 | | |

The strength of mapping is to be written as 1: Low, 2: Medium, 3: High
Each CO of the course must map to at least one PO.

**Assessment**

The assessment is based on MSE, ISE and ESE.
MSE shall be typically on modules 1 to 3.
ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO.
ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6.
For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

# Walchand College of Engineering, Sangli

*(Government Aided Autonomous Institute)*

## AY 2022-23

| Course Information | |
|---|---|
| **Programme** | B.Tech. (Computer Science and Engineering) |
| **Class, Semester** | Final Year B. Tech., Sem VII |
| **Course Code** | 5CS414 |
| **Course Name** | Elective- 6: Computer Vision |
| **Desired Requisites:** | Digital Image Processing |

| **Teaching Scheme** | | **Examination Scheme (Marks)** | | | |
|---|---|---|---|---|---|
| **Lecture** | 3 Hrs/week | **MSE** | **ISE** | **ESE** | **Total** |
| **Tutorial** | - | 30 | 20 | 50 | 100 |
| | | **Credits: 3** | | | |

| **Course Objectives** | |
|---|---|
| **1** | To impart knowledge of advanced techniques in computer vision. |
| **2** | To acquaint students with the concepts of color image processing, texture analysis, object recognition, video processing, 3D imaging etc. by applying the algorithms to build applications. |
| **3** | To allow students to compare various algorithms and select the one most appropriate for a particular application. |

**Course Outcomes (CO) with Bloom's Taxonomy Level**

At the end of the course, the students will be able to,

| **CO** | **Course Outcome Statement/s** | **Bloom's Taxonomy Level** | **Bloom's Taxonomy Description** |
|---|---|---|---|
| **CO1** | Demonstrate the knowledge of the various concepts of computer vision. | III | Applying |
| **CO2** | Apply and Analyse different computer vision algorithms to solve real life problems | IV | Analyze |
| **CO3** | Illustrate and critique different techniques employed in computer vision | V | Evaluate |

| **Module** | **Module Contents** | **Hours** |
|---|---|---|
| I | **Color Image Processing**<br>Color Fundamentals, Color models, Gray level to color transformations, Basics of Color Image Processing, Color Transformations, Smoothing and Sharpening, Color Segmentation | 6 |
| II | **Texture Analysis**<br>Definition, Types of texture, Texels, Texture analysis – concept and categories, Approaches to texture analysis, Statistics, Texture descriptors - statistical - Auto-correlation, co-occurrence matrices and features, edge density and direction, local binary partition, Law's texture energy measures, Wavelets and texture analysis. | 7 |
| III | **Representation & Description**<br>Representation, Boundary Descriptors, Regional Descriptors, Use of Principal components for description, Relational Descriptors | 6 |
| IV | **Object Recognition & Restoration**<br>**Object Recognition:** Object Detection Vs recognition, Patterns and Pattern Classes, Knowledge Representation, Statistical Pattern Recognition, Neural Nets, Syntactic Pattern Recognition,Optimization Techniques in Recognition.<br>**Restoration:** Image Restoration Model, Noise Models,Restoration using spatial filtering, Reduction using frequency domain filtering. | 8 |

| | | |
|---|---|---|
| V | **Moving Object Detection and Tracking**<br>Introduction, Background Modeling, Connected Component Labeling, Shadow Detection, Single Object Tracking, Discrete Kalman Filtering, Particle-filter based tracking, Mean-shift tracking, Segmentation tracking via graph cuts | 6 |
| VI | **3D Vision**<br>Introduction to 3D imaging ,applications. Case study based on the current trends in 3D imaging | 6 |
| | | |
| | **Textbooks** | |
| 1 | R. C. Gonzalez, R. E. Woods, Digital Image Processing, 4th Edition. 2018, PHI | |
| 2 | A. K. Jain, Fundamentals of Digital Image Processing, PHI | |
| | | |
| | **References** | |
| 1 | Milan Sonka, Vaclav Hlavac, Boyle, Digital Image Processing and Computer Vision, Cengage Learning | |
| 2 | S. Jayaraman, S. Esakkirajan, T. Veerkumar, Digital Image Processing, Tata McGrawHill | |
| 3 | Rafael C. Gonzalez, Richard E. Woods, Steven L. Eddins, Digital Image Processing Using MATLAB, 2nd ed. | |
| | | |
| | **Useful Links** | |
| 1 | NPTEL course: Link | |
| 2 | NPTEL course: Link | |

**CO-PO Mapping**

| | Programme Outcomes (PO) | | | | | | | | | | | | PSO | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| **CO1** | 2 | | | | | | | | | | | | | |
| **CO2** | 3 | | 2 | | | | | | | | | | | |
| **CO3** | | | 2 | 3 | | | | | | | | | | |

The strength of mapping is to be written as 1: Low, 2: Medium, 3: High
Each CO of the course must map to at least one PO.

**Assessment**

The assessment is based on MSE, ISE and ESE.
MSE shall be typically on modules 1 to 3.
ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO.
ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6.
For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

## Walchand College of Engineering, Sangli

*(Government Aided Autonomous Institute)*

**AY 2022-23**

| Course Information | |
|---|---|
| **Programme** | B.Tech. (Computer Science and Engineering) |
| **Class, Semester** | Final Year B. Tech., Sem VII |
| **Course Code** | 5CS415 |
| **Course Name** | Elective-6: MOOC on AI ML: Reinforcement Learning |
| **Desired Requisites:** | B.Tech. (Computer Science and Engineering) |

| Teaching Scheme | | Examination Scheme (Marks) | | | |
|---|---|---|---|---|---|
| **Lecture** | 3 Hrs/week | **MSE** | **ISE** | **ESE** | **Total** |
| **Tutorial** | - | 30 | 20 | 50 | 100 |
| | | **Credits: 3** | | | |

| Course Objectives | |
|---|---|
| **1** | To illustrate and apply the algorithm Reinforcement techniques. |
| **2** | To explain and demonstrate different reinforcement techniques for real world problem |
| **3** | To analyse reinforcement algorithm while applying to computation problem |

**Course Outcomes (CO) with Bloom's Taxonomy Level**

At the end of the course, the students will be able to,

| CO | Course Outcome Statement/s | Bloom's Taxonomy Level | Bloom's Taxonomy Description |
|---|---|---|---|
| **CO1** | Discuss the fundamentals of Reinforcement Learning. | II | Understanding |
| **CO2** | Apply knowledge of formulation of reinforcement techniques to solve real word solution | III | Applying |
| **CO3** | Critically analyze the various reinforcement techniques for a given problem. | IV | Analyzing |

| Module | Module Contents | Hours |
|---|---|---|
| I | Introduction, Bandit algorithms – UCB, PAC | 6 |
| II | Bandit algorithms –Median Elimination, Policy Gradient Full RL & MDPs | 7 |
| III | Bellman Optimalit, Dynamic Programming & TD Methods | 6 |
| IV | Eligibility Traces, Function Approximation | 7 |
| V | Least Squares Methods,Fitted Q, DQN & Policy Gradient for Full RL | 6 |
| VI | Hierarchical RL, POMDPs | 7 |

| Textbooks | |
|---|---|
| 1 | R. S. Sutton and A. G. Barto. Reinforcement Learning - An Introduction. MIT Press. 1998. |

| References | |
|---|---|
| 1 | R. S. Sutton and A. G. Barto. Reinforcement Learning - An Introduction. MIT Press. 1998. |

| Useful Links | |
|---|---|
| 1 | https://onlinecourses.nptel.ac.in/noc22_cs34/preview |

**CO-PO Mapping**

| | Programme Outcomes (PO) | | | | | | | | | | | | PSO | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| **CO1** | 2 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| **CO2** | 3 | 1 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| **CO3** | -- | 3 | -- | 2 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| **CO4** | -- | -- | -- | 2 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| **CO5** | -- | -- | 3 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| The strength of mapping is to be written as 1: Low, 2: Medium, 3: High<br>Each CO of the course must map to at least one PO. | | | | | | | | | | | | | | |

| **Assessment** |
|---|
| The assessment is based on MSE, ISE and ESE.<br>MSE shall be typically on modules 1 to 3.<br>ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO.<br>ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6.<br>For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing) |

# Walchand College of Engineering, Sangli

*(Government Aided Autonomous Institute)*

**AY 2022-23**

| Course Information | |
|---|---|
| **Programme** | B.Tech. (Computer Science and engineering) |
| **Class, Semester** | Final Year B. Tech., Sem VII |
| **Course Code** | 5CS451 |
| **Course Name** | Elective 5 Lab-High Performance Computing Lab |
| **Desired Requisites:** | Data structures, Basic Programming knowledge |

| **Teaching Scheme** | | **Examination Scheme (Marks)** | | | |
|---|---|---|---|---|---|
| **Practical** | 2 Hrs/ week | **LA1** | **LA2** | **Lab ESE** | **Total** |
| **Interaction** | - | 30 | 30 | 40 | 100 |
| | | **Credits: 1** | | | |

| **Course Objectives** | |
|---|---|
| **1** | To provide basics of parallel architectures |
| **2** | To provide basics of parallel algorithm design and analysis |
| **3** | To provide basics of parallel programming platforms |
| **4** | |

**Course Outcomes (CO) with Bloom's Taxonomy Level**

At the end of the course, the students will be able to,

| **CO** | **Course Outcome Statement/s** | **Bloom's Taxonomy Level** | **Bloom's Taxonomy Description** |
|---|---|---|---|
| **CO1** | Comparison of different parallel architectures and performance evaluation | I | Understand |
| **CO2** | To measure performance of model using different metrics | II | Apply |
| **CO3** | To design a parallelization strategy for computing patterns on different hardware and using different parallel computing languages. | VI | Create |

**List of Experiments / Lab Activities/Topics**

List of Topics(Applicable for Interaction mode ):

List of Lab Activities:

A. Implementation of following tasks using OpenMP.

1. Implementation of sum of two lower triangular matrices.
2. Implementation of Matrix-Matrix Multiplication.
3. Implementation of dot product
4. Implementation of Prefix sum

B. Implementation of following tasks using MPI.

5. Implementation of Matrix-Vector Multiplication.
6. Implementation of Matrix-Matrix Multiplication.
7. Implementation of 2D Convolution
8. Implementation of dot product
9. Implementation of Prefix sum

C. Implementation of following tasks using CUDA.

10. Implementation of Matrix-matrix Multiplication using global memory.
11. Implementation of Matrix-Matrix Multiplication using shared memory.
12. Implementation of Histogram
13. Implementation of Odd even sort
14. Implementation of Prefix sum
15. Implement 2D Convolution using shared memory

D. Performance evaluation of following computations using open source libraries or OpenACC compare to sequential and explicit parallel implementation

16. Implementation of Matrix-Matrix multiplication using OpenACC MKL, and cuBLAS. Compare their performance with OpenMP based implementation from assignment no.2, 10 and 11.

| | |
|---|---|
| **Textbooks** | |
| 1 | Zbigniew J. Czech, Introduction to Parallel Computing, Cambridge University Press, 2016. |
| 2 | Kumar, V., Grama, A., Gupta, A., & Karypis, G. (1994). Introduction to parallel computing (Vol. 110). Redwood City, CA: Benjamin/Cummings. |
| 3 | Chandra, R., Dagum, L., Kohr, D., Menon, R., Maydan, D., & McDonald, J. (2001). Parallel programming in OpenMP. Morgan kaufmann. |
| 4 | Cheng, J., Grossman, M., & McKercher, T. (2014). Professional CUDA c programming. John Wiley & Sons. |
| | |
| **References** | |
| 1 | Michael Quinn, Parallel Computing: Theory and Practice, McGrawHill Publishers, July 2017. |
| 2 | Arch Robison, James Reinders, and Michael Macoul, Structured Parallel Programming: Patterns for Efficient Computation, Morgan Kaufman, Elsevier, 2012. |
| | |
| **Useful Links** | |
| 1 | |

**CO-PO Mapping**

| | Programme Outcomes (PO) | | | | | | | | | | | | PSO | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| **CO1** | | | | 1 | 1 | | | | | | | | 1 | 1 |
| **CO2** | | | | 2 | 2 | | | | | | | | 2 | 1 |
| **CO3** | | | | 2 | 2 | | | | | | | | 2 | 1 |

The strength of mapping is to be written as 1,2,3; where, 1: Low, 2: Medium, 3: High

Each CO of the course must map to at least one PO, and preferably to only one PO.

| Assessment | | | | |
|---|---|---|---|---|
| There are three components of lab assessment, LA1, LA2 and Lab ESE.<br>IMP: Lab ESE is a separate head of passing.(min 40 %), LA1+LA2 should be min 40% | | | | |
| **Assessment** | **Based on** | **Conducted by** | **Typical Schedule** | **Marks** |
| LA1 | Lab activities, attendance, journal | Lab Course Faculty | During Week 1 to Week 8<br>Marks Submission at the end of Week 8 | 30 |
| LA2 | Lab activities, attendance, journal | Lab Course Faculty | During Week 9 to Week 16<br>Marks Submission at the end of Week 16 | 30 |
| Lab ESE | Lab activities, journal/ performance | Lab Course Faculty and External Examiner as applicable | During Week 18 to Week 19<br>Marks Submission at the end of Week 19 | 40 |
| Week 1 indicates starting week of a semester. Lab activities/Lab performance shall include performing experiments, mini-project, presentations, drawings, programming, and other suitable activities, as per the nature and requirement of the lab course. The experimental lab shall have typically 8-10 experiments and related activities if any. | | | | |

# Walchand College of Engineering, Sangli

*(Government Aided Autonomous Institute)*

**AY 2022-23**

**Course Information**

| | |
|---|---|
| **Programme** | B.Tech. (Computer Science and Engineering) |
| **Class, Semester** | Final Year B. Tech., SemVII |
| **Course Code** | 5CS452 |
| **Course Name** | Elective 5 lab- Data Mining Lab |
| **Desired Requisites:** | Database Engineering |

| **Teaching Scheme** | | **Examination Scheme (Marks)** | | | |
|---|---|---|---|---|---|
| **Practical** | 2 Hrs/ Week | **LA1** | **LA2** | **Lab ESE** | **Total** |
| **Interaction** | | 30 | 30 | 40 | 100 |
| | | **Credits: 1** | | | |

**Course Objectives**

| | |
|---|---|
| **1** | The hands-on and practically implementation of the concepts/techniques studied in theory course. |
| **2** | Exposure to real life data sets for analysis and prediction. |
| **3** | Learning performance evaluation of data mining algorithms in a supervised and an unsupervised mode with different data mining tools. |
| **4** | Handling a mini data mining project for a given practical domain. |

**Course Outcomes (CO) with Bloom's Taxonomy Level**

At the end of the course, the students will be able to,

| **CO** | **Course Outcome Statement/s** | **Bloom's Taxonomy Level** | **Bloom's Taxonomy Description** |
|---|---|---|---|
| **CO1** | Interpret the data mining process and handle important issues around data cleaning, pre-processing and integration. | III | Apply |
| **CO2** | Analyse the real world problems using different data mining algorithms. | IV | Analyze |
| **CO3** | Measure the performance of different data mining algorithms / tools. | V | Evaluate |
| **CO4** | Design and build the data mining system for solving any complex problem. | VI | Create |

**List of Experiments / Lab Activities/Topic**

**List of Lab Activities:**

1. For iris and breast cancer data set
   a) Calculate the mean, median, and standard deviation of conditional attributes.
   b) Draw histogram
   c) Draw the boxplots for pairs of attributes.
   d) Draw a scatter plot and a Quantile-Quantile (q-q) plot based on these two variables.

2. For iris and breast cancer data set, perform the
   a) Correlation analysis
   b) discretization using Binning and Histogram Analysis

3. Design and implementation of following classifiers :
   a. Regression classifier.
   b. Naïve Bayesian Classifier.
   c. k-NN classifier (Take k = 1,3,5,7)
   d. Three layer Artificial Neural Network (ANN) classifier (use back propagation)

4. Design and implementation of following clustering algorithms :
   a) Hierarchical clustering - AGNES & DIANA. Plot Dendrogram.
   b) k-Means
   c) k-Medoids (PAM)
   d) DBSCAN

5. Design and implementation of following Association Rule Mining algorithms :
   a) Basic Association Rule Mining Algorithm
   b) Apriori Algorithm

6. Design and implementation of following Web Mining algorithms :
   a) Implement the PageRank algorithm to calculate the rank of each page in the file. The outputshould be the 10 pages with the highest rank, together with their rank values.
   b) Implement the HITS algorithm to calculate the hub and the authority weight of each web page inthe data set. The output should be the 10 most authoritative pages and 10 most hubby pages.

7. Hands on with the state of the art data analytics tools like Tableau , Weka , SPSS, Oracle DataMiner etc.

8. Mini-project : Group (2/3) of students should search any research journal / literature on data miningand select small problem statement. Design and build the data mining system for chosen problem. OR instructor may assign any problem statement for each group.

**Instructions :**

1. Use the standard data sets from UCI Machine Learning Repository
2. Follow the design, modelling and implementation/documentation methodology using standard CASEtools.
3. Use Python as Programming Language. For database programming / scripting use PL/SQL T-SQL,MySQL/Oracle 11g /IBM DB2 9.7 as backend database server. Follow the submission guidelines.

| Textbooks | |
|---|---|
| 1 | Jiawei Han , Micheline Kamber and Jian Pei , “Data Mining - Concepts and Techniques” , Third Edition, Morgan Kaufmann, 2012, ISBN 978-0-12-381479-1 |
| 2 | Dunham, Margaret H , “Data Mining: Introductory and Advanced Topics”, 1st Edition , PHI/Pearson, 2006 , ISBN 978-81-7758-785-2 |
| 3 | |
| 4 | |

**References**

| | |
|---|---|
| 1 | Sumathi, S., Sivanandam, S.N. , “Introduction to Data Mining and its Applications”, Springer , 2006 , ISBN 978-3-540-34351-6 |
| 2 | P. Tan, M. Steinbach and V. Kumar, "Introduction to Data Mining", 2nd Edition, Addison Wesley, 2019, |
| 3 | Related papers from various IEEE Transactions , Int. Journals / Conferences. |
| 4 | Open source tools for data analytics and machine learning. |
| | |
| **Useful Links** | |
| 1 | Data sets : https://archive.ics.uci.edu/ml/index.php |
| 2 | Tableau tool : https://www.tableau.com/developer/tools |
| 3 | SPSS tool : https://www.ibm.com/in-en/analytics/spss-statistics-software |
| 4 | Weka tool : https://www.cs.waikato.ac.nz/ml/weka/ |

| **CO-PO Mapping** | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Programme Outcomes (PO)** | | | | | | | | | | | | **PSO** | |
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| **CO1** | 3 | | | | | | | | | | | | 1 | |
| **CO2** | | 3 | | | | | | | | | | | | 2 |
| **CO3** | | | | | 2 | | | | | | | | 3 | |
| **CO4** | | | 3 | | | | | | | | | | | 3 |
| The strength of mapping is to be written as 1,2,3; where, 1: Low, 2: Medium, 3: High<br>Each CO of the course must map to at least one PO, and preferably to only one PO. | | | | | | | | | | | | | | |

| **Assessment** | | | | |
|---|---|---|---|---|
| There are three components of lab assessment, LA1, LA2 and Lab ESE.<br>IMP: Lab ESE is a separate head of passing.(min 40 %), LA1+LA2 should be min 40% | | | | |
| **Assessment** | **Based on** | **Conducted by** | **Typical Schedule** | **Marks** |
| LA1 | Lab activities, attendance, journal | Lab Course Faculty | During Week 1 to Week 8<br>Marks Submission at the end of Week 8 | 30 |
| LA2 | Lab activities, attendance, journal | Lab Course Faculty | During Week 9 to Week 16<br>Marks Submission at the end of Week 16 | 30 |
| Lab ESE | Lab activities, journal/ performance | Lab Course Faculty and External Examiner as applicable | During Week 18 to Week 19<br>Marks Submission at the end of Week 19 | 40 |
| Week 1 indicates starting week of a semester. Lab activities/Lab performance shall include performing experiments, mini-project, presentations, drawings, programming, and other suitable activities, as per the nature and requirement of the lab course. The experimental lab shall have typically 8-10 experiments and related activities if any. | | | | |

| **Walchand College of Engineering, Sangli**<br>*(Government Aided Autonomous Institute)* | | | | | |
|---|---|---|---|---|---|
| **AY 2022-23** | | | | | |
| **Course Information** | | | | | |
| **Programme** | B. Tech. (Computer Science and Engineering) | | | | |
| **Class, Semester** | Final Year B. Tech., Sem VII | | | | |
| **Course Code** | 5OE471 | | | | |
| **Course Name** | Open Elective 5: Cyber Security | | | | |
| **Desired Requisites:** | | | | | |

| **Teaching Scheme** | | **Examination Scheme (Marks)** | | | |
|---|---|---|---|---|---|
| **Lecture** | 3 Hrs/week | **MSE** | **ISE** | **ESE** | **Total** |
| **Tutorial** | - | 30 | 20 | 50 | 100 |
| | | **Credits: 3** | | | |

| **Course Objectives** | |
|---|---|
| **1** | Exhibit knowledge to secure corrupted systems, protect personal data, and secure computer networks in an Organization |
| **2** | Develop cyber security strategies and policies |
| **3** | Understand principles of web security and to guarantee a secure network by monitoring and analyzing the nature of attacks through cyber/computer forensics software/tools. |

**Course Outcomes (CO) with Bloom's Taxonomy Level**

At the end of the course, the students will be able to,

| **CO** | **Course Outcome Statement/s** | **Bloom's Taxonomy Level** | **Bloom's Taxonomy Description** |
|---|---|---|---|
| **CO1** | Understand the concepts of cyber security and data privacy in today's environment. | II | Understand |
| **CO2** | Perform fundamental incident response functions including detecting, responding, and recovering from security incidents. | III | Apply |
| **CO3** | Analyze and resolve security issues in networks and computer systems to secure an IT infrastructure | IV | Analyze |
| **CO4** | Evaluate and communicate the human role in security systems with an emphasis on ethics, social engineering vulnerabilities and training. | V | Evaluate |
| **CO5** | Design appropriate security technologies and policies to protect computers and digital information. | VI | Create |

| **Module** | **Module Contents** | **Hours** |
|---|---|---|
| I | **Introduction to Cyber Space**<br>Internet Architecture and the Protocol Layers- Basics of Internet, Layered architecture, OSI Reference Model, Protocol Data Unit(PDU), TCP/IP Model, IP addressing, Layers of security, Cyber Crime, Information Security, CIA Triad, Computer Ethics & Security Policies. | 7 |
| II | **Web Browsers and Email Security**<br>Basics of Cryptography, Guidelines to choose Web Browsers, Security measures for using Web Browsers, Antivirus, Email Security, IDS, Firewall. | 7 |
| III | **Social Media and basic Windows Security**<br>Guidelines for Social Media Security, Tips & best practices for Safer Social Media Networking, Best Security Practices for Windows Desktops & Laptops, Guidelines for generation of User Accounts & Passwords, Wi-Fi Security. | 6 |
| IV | **Smartphone Security**<br>Introduction to Mobile Devices, Security Techniques for using Mobile Devices, Best Security Practices for Android Devices, Best Security Practices for IOS Devices. | 6 |

| | | |
|---|---|---|
| V | **Online Banking, Credit Card & UPI Security, POS & ATM Security**<br>Online Banking Security Techniques, Mobile Banking Security Techniques, Security for Debit & Credit Cards, UPI & e-Wallet Security Guidelines, Security for using Micro-ATMs & POS (Point of Sales). | 7 |
| VI | **Cyber Security Initiatives in India**<br>Counter Cyber Security Initiatives in India, Cyber Security Incident Handling, **Information Destroying and Recovery Tools-** Recovering from Information Loss, Destroying Sensitive Information, CCleaner for Windows, How Cyber Criminal Works & Cyber Laws, IT ACT & how to prevent yourself from being a victim of Cyber Crime, **Cybercrime: Examples and Mini-Cases.** | 7 |

| **Textbooks** | |
|---|---|
| 1 | Nina Godbole and Sunit Belpure, "*Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives"*, Wiley |
| 2 | B. B. Gupta, D. P. Agrawal, Haoxiang Wang, *"Computer and Cyber Security: Principles, Algorithm, Applications, and Perspectives"*, CRC Press, ISBN 9780815371335, 2018 |

| **References** | |
|---|---|
| 1 | "*Cyber Security Essentials*", James Graham, Richard Howard and Ryan Otson, CRC Press |

| **Useful Links** | |
|---|---|
| 1 | https://onlinecourses.swayam2.ac.in/ugc19_hs25/preview m2.ac.in |
| 2 | https://www.classcentral.com/course/swayam-introduction-to-cyber-security-14116 |
| 3 | https://www.youtube.com/watch?v=AU3sdN-ZPCQ |

**CO-PO Mapping**

| | Programme Outcomes (PO) | | | | | | | | | | | | PSO | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| **CO1** | 3 | 3 | | | | | | | | | | | 2 | |
| **CO2** | | 3 | | | 2 | | | | | | | | 3 | |
| **CO3** | 3 | 3 | | | | | | | | | | | 3 | 3 |
| **CO4** | | 2 | 3 | | | | | | | | | | 3 | 1 |
| **CO5** | | | | 3 | | | | | | | | | 2 | |

The strength of mapping is to be written as 1: Low, 2: Medium, 3: High
Each CO of the course must map to at least one PO.

**Assessment**

The assessment is based on MSE, ISE and ESE.
MSE shall be typically on modules 1 to 3.
ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO.
ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6.
For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

# Walchand College of Engineering, Sangli

*(Government Aided Autonomous Institute)*

**AY 2022-23**

**Course Information**

| | |
|---|---|
| **Programme** | B.Tech. (Computer Science and Engineering) |
| **Class, Semester** | Final Year B. Tech., Sem VIII |
| **Course Code** | 5CS421 |
| **Course Name** | Industry Course : Data Management, Protection and Governance (By Veritas) |
| **Desired Requisites:** | |

| **Teaching Scheme** | | **Examination Scheme (Marks)** | | | |
|---|---|---|---|---|---|
| **Lecture** | 3 Hrs/week | **MSE** | **ISE** | **ESE** | **Total** |
| **Tutorial** | - | 30 | 20 | 50 | 100 |
| | | **Credits: 3** | | | |

**Course Objectives**

| | |
|---|---|
| **1** | Get acquainted with the high-level phases of data life cycle management. |
| **2** | Acquire knowledge about the various aspects of data storage, data availability, data protection. |
| **3** | Gain exposure to various solutions/reference architectures for various use-cases. |
| **4** | Understand the technical capabilities and business benefits of data protection. |

**Course Outcomes (CO) with Bloom's Taxonomy Level**

At the end of the course, the students will be able to,

| **CO** | **Course Outcome Statement/s** | **Bloom's Taxonomy Level** | **Bloom's Taxonomy Description** |
|---|---|---|---|
| **CO1** | Illustrate data management world and various types of data threats and approaches to ensure data center security. | II | Understand |
| **CO2** | Apply different standards for compliance and governance of data. | III | Apply |
| **CO3** | Analyze various types of data threats and approaches to ensure data centre security. | IV | Analyze |
| **CO4** | Discriminate various concepts and technologies for enabling data storage and high availability | V | Evaluate |
| **CO5** | Design data intensive enterprise applications and industry standard solutions in data management. | VI | Create |

| **Module** | **Module Contents** | **Hours** |
|---|---|---|
| I | **Introduction to data life cycle management (DLM)**<br>Goals of data life cycle management, Challenges involved- Volume of data source, Ubiquity of data locations, User demand for access, Stages of data life cycle – creation, storage, usage, archival, destruction, Risks involved without DLM, benefits, best practices. | 4 |
| II | **Data storage and data availability**<br>**Storage technology**: Hard Disk Device (HDD), Solid State Devices (SSD), memory devices, Data access - block, files, object, Data center End to End View – overview of complete stack including storage, network, host, cluster, applications, virtual machines, cloud storage, Storage virtualization technologies - RAID level, storage pooling, storage provisioning, Advance topics in storage virtualization – storage provisioning, thin provisioning, Cloud storage – S3, glacier, storage tiering, High Availability-Introduction to high availability, clustering, failover, parallel access, Disaster Recovery -Need of disaster recovery, Building blocks - global cluster, wide-area-connector (WAC), heartbeat,<br>Split-brain – problem and solutions , Preparing for DR – firedrill. | 8 |

| | | |
|---|---|---|
| III | **Data Threats and Data center security**<br>Type of Threats-Denial of Service (DoS), man in the middle attacks, Unintentional data loss, Repudiation, Malicious attacks to steal data, Understanding, Identification and Threat modelling tools, Introduction to Ransomware, Security- Authorization and authentication - access control, Transport Layer Security (TLS), key management, security in cloud,<br>Design and architecture considerations for security. | 7 |
| IV | **Introduction to data protection**<br>Introduction-Need for data protection, basic of back-up/restore, Snapshots for data protection, copy-data management (cloning, DevOps), De- duplication, Replication, Long Term Retention – LTR, Archival, Design considerations-System recovery, Solution architecture, Backup v/s Archival, media considerations and management (tapes, disks, cloud),<br>challenges with new edge technology (cloud, containers). | 8 |
| V | **Data regulation, compliance and governance**<br>Regulations requirements and Privacy Regulations-General Data Protection Regulation (GDPR), The Health Insurance Portability and Privacy Act of 1996 (HIPPA), PII (Personal Identity Information), Information Governance-Auditing, Legal Hold, Data classification and<br>tagging (Natural Language Processing). | 5 |
| VI | **Applications uninterrupted**<br>Understand data management aspects of traditional and new edge applications, Reference architecture/best practices (pick 2-3 case studies from below topics)-Transactional Databases (Oracle, MySQL, DB2), NoSQL Databases (MongoDB, Cassandra), Distributed applications (micro service architectures), Cloud applications – Platform as Service (PaaS), Software as Service (SaaS), Kubernetes, Multi-Tiered applications, ETL workloads, Data analytics (AI/ML). | 7 |

| **Textbooks** | |
|---|---|
| 1 | Robert Spalding, "*Storage Networks: The complete Reference*" Tata McGraw-Hill |
| 2 | Vic (J.R.) Winkler, "Securing The Cloud: Cloud Computing Security Techniques and Tactics" (Syngress/Elsevier) - 978-1-59749-592-9. |
| 3 | TBD – online reference for each topic. |

| **References** | |
|---|---|
| 1 | "Designing Data-Intensive Applications " (O'Reilly, Martin Kleppmann). |
| 2 | TBD: provide more online material details and books (This can include some publicly available white-paper, solution guides etc.) |

| **Useful Links** | |
|---|---|
| 1 | https://www.enterprisestorageforum.com/storage-hardware/storage-virtualization.html |
| 2 | https://www.hitechnectar.com/blogs/three-goals-data-lifecycle-management/ |
| 3 | https://www.bmc.com/blogs/data-lifecycle-management/ |
| 4 | https://www.dataworks.ie/5-stages-in-the-data-management-lifecycle-process/ |

**CO-PO Mapping**

| | Programme Outcomes (PO) | | | | | | | | | | | | PSO | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| **CO1** | | 3 | | | | | | | | | | | 2 | |
| **CO2** | 3 | | | | | | | | | | | | 3 | |
| **CO3** | 3 | 2 | | | | | | | | | | | | 3 |
| **CO4** | | 3 | | | | | | | | | | | | 1 |
| **CO5** | | 3 | | | | | | | | | | | | |

The strength of mapping is to be written as 1: Low, 2: Medium, 3: High
Each CO of the course must map to at least one PO.

| Assessment |
| --- |
| The assessment is based on MSE, ISE and ESE.<br>MSE shall be typically on modules 1 to 3.<br>ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO.<br>ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6.<br>For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing) |

# Walchand College of Engineering, Sangli

*(Government Aided Autonomous Institute)*

**AY 2022-23**

| Course Information | |
|---|---|
| **Programme** | B.Tech. (Computer Science and engineering) |
| **Class, Semester** | Final Year B. Tech., Sem VIII |
| **Course Code** | 5CS492 |
| **Course Name** | Project-II |
| **Desired Requisites:** | Nil |

| Teaching Scheme | | Examination Scheme (Marks) | | | |
|---|---|---|---|---|---|
| **Practical** | 12 Hrs/ week | **LA1** | **LA2** | **Lab ESE** | **Total** |
| **Interaction** | - | 30 | 30 | 40 | 100 |
| | | **Credits: 6** | | | |

| Course Objectives | |
|---|---|
| **1** | To experience project management principles to become IT industry savvy. |
| **2** | To utilize state of the art CASE tools especially for design, development and testing phases. |
| **3** | To acquaint the ability to map technical skills to real life applications from customers perspective. |
| **4** | To practice of specifying & using artifacts as per quality standards. |

**Course Outcomes (CO) with Bloom's Taxonomy Level**

At the end of the course, the students will be able to,

| CO | Course Outcome Statement/s | Bloom's Taxonomy Level | Bloom's Taxonomy Description |
|---|---|---|---|
| **CO1** | demonstrate the state-of-art technological trends through planning and design project aspects. | III | Apply |
| **CO2** | adopt agile methodology and mature team skills through various SDLC phases. | V | Evaluate |
| **CO3** | showcase the project with real life use case mainly to potential customers. | VI | Create |
| **CO4** | analyse performance of developed product and write/publish technical artifacts | IV | Analyse |

**List of Experiments / Lab Activities/Topics**

**List of Topics(Applicable for Interaction mode ):**

**List of Lab Activities:**

1. Preferably project work is to be continued from Project-I
2. Students should maintain a project log book containing weekly progress of the project
3. At the end of the semester project group should achieve all the proposed objectives of the problem statement.
4. The work should be completed in all aspects of design, implementation and testing.
5. Project report and technical artifacts should be prepared, submitted in soft and hard form along with all the code and datasets.
6. Group should demonstrate the work with various test cases and results obtained and explain future scope.
7. The group should participate in technical symposiums, paper presentations to demonstrate their work and findings in technical community.

| Textbooks | |
|---|---|
| 1 | Nil |

| References | |
|---|---|
| 1 | Nil |

| | |
|---|---|
| **Useful Links** | |
| 1 | |

| **CO-PO Mapping** | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Programme Outcomes (PO)** | | | | | | | | | | | | **PSO** | |
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| **CO1** | -- | -- | -- | -- | -- | -- | -- | 3 | 2 | -- | -- | -- | -- | -- |
| **CO2** | -- | -- | -- | -- | 3 | -- | -- | -- | 2 | 3 | -- | -- | -- | -- |
| **CO3** | -- | -- | 2 | 3 | -- | -- | -- | -- | -- | -- | 2 | -- | -- | -- |
| **CO4** | -- | -- | -- | -- | 2 | -- | -- | -- | 2 | -- | -- | -- | -- | -- |
| The strength of mapping is to be written as 1,2,3; where, 1: Low, 2: Medium, 3: High<br>Each CO of the course must map to at least one PO, and preferably to only one PO. | | | | | | | | | | | | | | |

| **Assessment** | | | | |
|---|---|---|---|---|
| There are three components of lab assessment, LA1, LA2 and Lab ESE.<br>IMP: Lab ESE is a separate head of passing.(min 40 %), LA1+LA2 should be min 40% | | | | |
| **Assessment** | **Based on** | **Conducted by** | **Typical Schedule** | **Marks** |
| LA1 | Lab activities, attendance, journal | Lab Course Faculty | During Week 1 to Week 8<br>Marks Submission at the end of Week 8 | 30 |
| LA2 | Lab activities, attendance, journal | Lab Course Faculty | During Week 9 to Week 16<br>Marks Submission at the end of Week 16 | 30 |
| Lab ESE | Lab activities, journal/ performance | Lab Course Faculty and External Examiner as applicable | During Week 18 to Week 19<br>Marks Submission at the end of Week 19 | 40 |
| Week 1 indicates starting week of a semester. Lab activities/Lab performance shall include performing experiments, mini-project, presentations, drawings, programming, and other suitable activities, as per the nature and requirement of the lab course. The experimental lab shall have typically 8-10 experiments and related activities if any. | | | | |

| Walchand College of Engineering, Sangli<br>*(Government Aided Autonomous Institute)* | |
|---|---|
| **AY 2022-23** | |
| **Course Information** | |
| **Programme** | B.Tech. (Computer Science and Engineering) |
| **Class, Semester** | Final Year B. Tech., Sem VIII |
| **Course Code** | 5CS431 |
| **Course Name** | Elective-7:Search Engine Design and Optimization |
| **Desired Requisites:** | Programming Laboratory – 3 |

| **Teaching Scheme** | | **Examination Scheme (Marks)** | | | |
|---|---|---|---|---|---|
| **Lecture** | 3 Hrs/week | **MSE** | **ISE** | **ESE** | **Total** |
| **Tutorial** | - | 30 | 20 | 50 | 100 |
| | | **Credits: 3** | | | |

| **Course Objectives** | |
|---|---|
| **1** | To inculcate understanding of detailed functions of search engines and different SEO techniques. |
| **2** | To illustrate working of different search engine designs and different SEO techniques. |
| **3** | To emphasize on optimizing design of search engines and use of SEO techniques. |

**Course Outcomes (CO) with Bloom's Taxonomy Level**

At the end of the course, the students will be able to,

| **CO** | **Course Outcome Statement/s** | **Bloom's Taxonomy Level** | **Bloom's Taxonomy Description** |
|---|---|---|---|
| **CO1** | describe working of search engines and SEO techniques | II | Understand |
| **CO2** | illustrate various SEO techniques and use SEO tools | III | Apply |
| **CO3** | comprehend strengths and weaknesses of SEO techniques and use appropriate SEO technique as per real life scenario and analyze the performance of a website on a search engine using tools and analytical data | IV | Analyze |

| **Module** | **Module Contents** | **Hours** |
|---|---|---|
| I | **Search Engines and SEO Overview**<br>SEO – What is it, History, Evolution and Importance, Types of SEO Techniques, How Search Engines Work, SERP, Google Search Engine Architecture and Algorithm, How Machine Learning in Search Works, Panda Update, Other advanced Search Engine algorithms | 5 |
| II | **Keyword Research and Analysis**<br>What is keyword, Importance of Keyword, Keyword Phrases and Keyword Length, Keyword-Value Pyramid, where to start, Keyword Density, Finding Keywords, Keyword Selection Tips, Common<br>Keyword Problems and Solutions, Keyword Analysis Tools | 6 |
| III | **On-page Optimization Techniques**<br>The difference – On-page and Off-page optimization,<br>On-page Optimization Techniques - The Page Title, Meta Descriptions & Meta Keywords, Headings, Bold Text, Domain Names & Suggestions, Canonical Tag, Meta Tags, Images and Alt Text, Internal Link Building, The Sitemap, Invisible Text, Server and Hosting Check, Robots Meta<br>Tag, Doorway Pages, 301 Redirects, 404 Error, Duplicate content | 9 |

| | | |
|---|---|---|
| IV | **Off-page Optimization Techniques**<br>Local marketing of websites on the basis of locations, Social Media optimization techniques, Introduction of link building and its types, Directory submission, Blog and article submission, Forum posting, Forum signatures and commenting, Free classifieds, Classifieds posting, Press release submission, Video submission, Business listing submission, Guest blog, Detail knowledge on Link building and backlinks, Social bookmarking, Photo & Video Sharing, Infographics sharing, Document Sharing, Content Marketing and its importance, Question and answers, Web 2.0 submission, Importance of backlinks / Link building, Home page promoting tips and techniques, Strategies to build qualitative and relevant backlinks, Competitors backlink research and submission. Tracking the links, Submission to do follow websites, RSS Feed submissions. | 7 |
| V | **User Interface, Local and Social Media SEO**<br>UX/UI, SEO and UX/UI, Best Practices.<br>Local SEO and its importance, Local Searches, NAP, Directories, Top Local Search Signals, Reviews and Feedback.<br>Introduction to Social Media SEO and their importance, Social Media Impact on SEO, Social Media and Local SEO. | 6 |
| VI | **SEO Tools, Reporting and Tracking**<br>Keyword Research Tools, On-page SEO Tools, Link Building Tools, Technical SEO Tools, Rank Tracking Tools, Analytics Tools, and Local SEO Tools. | 6 |

| **Textbooks** | |
|---|---|
| 1 | Jessie Stricchiola, Stephan Spencer, Eric Enge, “The Art of SEO - Mastering Search Engine Optimization”. |
| 2 | Moz, “Beginner's Guide to SEO”. |

| **References** | |
|---|---|
| 1 | Adam Clarke, “SEO 2021: Learn search engine optimization with smart internet marketing” |

| **Useful Links** | |
|---|---|
| 1 | https://analytics.google.com/analytics/academy/course/6 |

**CO-PO Mapping**

| | **Programme Outcomes (PO)** | | | | | | | | | | | | **PSO** | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| **CO1** | | 1 | | | | | | | | | | | 1 | |
| **CO2** | 2 | 2 | 3 | | | | | | | | | | 2 | |
| **CO3** | | 3 | 2 | | 3 | | | | | | | | 2 | 1 |

The strength of mapping is to be written as 1: Low, 2: Medium, 3: High
Each CO of the course must map to at least one PO.

**Assessment**

The assessment is based on MSE, ISE and ESE.
MSE shall be typically on modules 1 to 3.
ISE shall be taken throughout the semester in the form of teacher’s assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO.
ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6.
For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

| Walchand College of Engineering, Sangli<br>*(Government Aided Autonomous Institute)* | |
|---|---|
| **AY 2022-23** | |
| **Course Information** | |
| **Programme** | B.Tech. (Computer Science and Engineering) |
| **Class, Semester** | Final Year B. Tech., Sem VIII |
| **Course Code** | 5CS432 |
| **Course Name** | Elective-7: Computer Forensic |
| **Desired Requisites:** | Cyber Security |

| **Teaching Scheme** | | **Examination Scheme (Marks)** | | | |
|---|---|---|---|---|---|
| **Lecture** | 3 Hrs/week | **MSE** | **ISE** | **ESE** | **Total** |
| **Tutorial** | - | 30 | 20 | 50 | 100 |
| | | **Credits: 3** | | | |

| **Course Objectives** | |
|---|---|
| **1** | To understand the basic digital forensics and techniques for conducting the forensic examination on different digital devices. |
| **2** | To understand how to examine digital evidence such as data acquisition, identification analysis. |
| **3** | To understand cyber related crimes and various investigative strategies |
| **4** | To understand various data storage methods, formats and computer forensic tools |

**Course Outcomes (CO) with Bloom's Taxonomy Level**

At the end of the course, the students will be able to,

| **CO** | **Course Outcome Statement/s** | **Bloom's Taxonomy Level** | **Bloom's Taxonomy Description** |
|---|---|---|---|
| **CO1** | Apply the methods for data recovery, evidence collection and data seizure. | III | Applying |
| **CO2** | Analyze a large amount of digital evidence and identify the most significant data. | IV | Analysing |
| **CO3** | Evaluate the different types of computer forensics technologies | V | Evaluating |
| **CO4** | Apply a number of different computer forensic tools to a given scenario. | III | Applying |

| **Module** | **Module Contents** | **Hours** |
|---|---|---|
| I | **Introduction**<br>Computer forensics fundamentals, Benefits of forensics, computer crimes, computer forensics evidence and courts, legal concerns and private issues. | 6 |
| II | **Understanding Computing Investigations**<br>Procedure for corporate High-Tech investigations, understanding data recovery workstation and software, conducting investigations. | 6 |
| III | **Methods of Storing Data**<br>Understanding the binary number system & Conversions, Encoding and Decoding formats, Methods of storing data, Computer Memory, Development of hard disk, physical construction, CHS & LBA addressing, Understanding file system and file formats, Cloud storage and forensics. | 6 |

| | | |
|---|---|---|
| IV | **Storage Formats and Digital Evidence**<br>Data acquisition- understanding storage formats and digital evidence, determining the best acquisition method, acquisition tools, validating data acquisitions, performing RAID data acquisitions, remote network acquisition tools, other forensics acquisitions tools. | 7 |
| V | **Cyber Crime and Incident Response**<br>Processing crimes and incident scenes, securing a computer incident or crime, seizing digital evidence at scene, storing digital evidence, obtaining digital hash, reviewing case. | 6 |
| VI | **Computer Forensics Tools**<br>Software, hardware tools, validating and testing forensic software, addressing data-hiding techniques, performing remote acquisitions, E-Mail investigations- investigating email crime and violations, understanding E-Mail servers, Specialized E-Mail forensics tool. | 8 |

| **Textbooks** | |
|---|---|
| 1 | Warren G. Kruse II and Jay G. Heiser, “Computer Forensics: Incident Response Essentials”, Addison Wesley |
| 2 | B Nelson, B, Phillips, A, Enfinger, F, Stuart, C., “Guide to Computer Forensics and Investigations”, 2nd ed., Thomson Course Technology |
| 3 | |
| 4 | |

| **References** | |
|---|---|
| 1 | Vacca, J, “Computer Forensics, Computer Crime Scene Investigation”, 2nd Ed, Charles River Media, ISBN: 1-58450-38 |
| 2 | |
| 3 | |
| 4 | |

| **Useful Links** | |
|---|---|
| 1 | |
| 2 | |
| 3 | |
| 4 | |

**CO-PO Mapping**

| | Programme Outcomes (PO) | | | | | | | | | | | | PSO | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| **CO1** | 3 | 3 | 2 | | | | | | | | | | 2 | |
| **CO2** | 1 | 1 | 2 | | | | | | | | | | 3 | |
| **CO3** | 3 | 3 | | | | | | | | | | | 2 | 3 |
| **CO4** | 3 | 2 | | | 3 | | | | | | | | 2 | 1 |

The strength of mapping is to be written as 1: Low, 2: Medium, 3: High
Each CO of the course must map to at least one PO.

**Assessment**

| |
|---|
| The assessment is based on MSE, ISE and ESE.<br>MSE shall be typically on modules 1 to 3.<br>ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO.<br>ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6.<br>For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing) |

| Walchand College of Engineering, Sangli<br>*(Government Aided Autonomous Institute)* | | | | | | |
|---|---|---|---|---|---|---|
| **AY 2022-23** | | | | | | |
| **Course Information** | | | | | | |
| **Programme** | | B.Tech. (Computer Science and Engineering) | | | | |
| **Class, Semester** | | Final Year B. Tech., Sem VIII | | | | |
| **Course Code** | | 5CS433 | | | | |
| **Course Name** | | Elective-8: Human Computer Interaction | | | | |
| **Desired Requisites:** | | Nil | | | | |
| | | | | | | |
| **Teaching Scheme** | | **Examination Scheme (Marks)** | | | | |
| **Lecture** | 3 Hrs/week | **MSE** | **ISE** | **ESE** | **Total** | |
| **Tutorial** | - | 30 | 20 | 50 | 100 | |
| | | **Credits: 3** | | | | |

| **Course Objectives** | |
|---|---|
| **1** | To inculcate understanding of detailed functions of HCI and different HCI techniques. |
| **2** | To illustrate working of different HCI designs and different HCI techniques. |
| **3** | To emphasize on HCI evaluation and Implementation techniques. |

**Course Outcomes (CO) with Bloom's Taxonomy Level**

At the end of the course, the students will be able to,

| **CO** | **Course Outcome Statement/s** | **Bloom's Taxonomy Level** | **Bloom's Taxonomy Description** |
|---|---|---|---|
| **CO1** | Describe working of HCI and HCI basics. | II | Understand |
| **CO2** | Illustrate various HCI design principals. | III | Apply |
| **CO3** | Comprehend strengths and weaknesses of HCI design techniques and use appropriate HCI technique as per real life. | IV | Analyze |

| **Module** | **Module Contents** | **Hours** |
|---|---|---|
| I | **Foundations of Human–Computer Interaction**<br><br>What is HCI – design, models, evaluation, Need to understand people, computers and methods. Basic human abilities - vision, hearing, touch, memory. Computers – speed, interfaces, widgets, and effects on interaction. Humans – Memory, Attention Span, Visual Perception, psychology, ergonomics. Understanding Users. Methods for evaluation of interfaces with users: goals of evaluation, approaches, ethics, introspection, extracting the conceptual model, direct observation, constructive interaction, interviews and questionnaires, continuous evaluation via user feedback and field studies, choosing an evaluation method. | 07 |
| II | **The Design Process**<br><br>Interaction Design Basics, Interaction Styles. HCI in the Software Process. HCI design principles and rules: design principles, principles to support usability, golden rules and heuristics, HCI patterns, design rules, HCI design standards. Universal Design, User-centered design, task analysis/GOMS, Graphic Design, Real life scenario study in design process. | 06 |
| III | **Implementation**<br>Implementation Tools, Technology and change designing for the Web, designing for portable devices. Handling errors and Designing Help. Prototyping and UI Software. Real life scenario study in implementation process. | 07 |

| | | |
|---|---|---|
| IV | **Evaluation and User Support**<br>Evaluation of User Interfaces. Web Browsers - Fonts, Color Palette, Color Depth, Resolution, Layout, Size, Orientation. Mobile devices issues – design, limitations, what next. User Support, Real life scenario study in implementation process. | 07 |
| V | **Users Models**<br><br>Predictive Models, Cognitive Models. Interaction with Natural Languages, Next Generation Interface. Socio-organizational Issues and Stakeholder Requirements. Heuristic Evaluation, Evaluation with Cognitive Models, Evaluation with Users, Real life scenario study in implementation process. | 06 |
| VI | **Case Study of Modern Systems**<br>Group ware, Virtual Reality, Augmented Reality, Hypertext, Multimedia and World Wide web, GUI design for a mobile phone based Matrimonial application during emergency. | 06 |

| | |
|---|---|
| | **Textbooks** |
| 1 | Alan J, Dix. Janet Finlay, Rusell Beale, "Human Computer Interaction", Pearson Education, 3rd Edition, 2004, ISBN 81-297-0409-9 |
| 2 | Jenny Preece, Rogers, Sharp, “Interaction Design-beyond human-computer interaction”, WILEY-INDIA, ISBN 81-265-0393-9 |
| | **References** |
| 1 | Jonathan Lazar, Jinjuan Feng, Harry Hochheiser, “Research Methods in Human-Computer Interaction", Third Edition, Morgan Kaufmann, 2017, ISBN: 9780128053904. |
| 2 | Mary Beth Rosson and John M. Carroll, “Usability Engineering: Scenario-Based Development of Human-Computer Interaction”, Morgan Kaufmann, 2001, ISBN-13: 978- 1558607125 |
| | **Useful Links** |
| 1 | https://nptel.ac.in/courses/106/103/106103115/ |
| 2 | https://www.coursera.org/learn/human-computer-interaction |

**CO-PO Mapping**

| | Programme Outcomes (PO) | | | | | | | | | | | | PSO | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| **CO1** | | 1 | | | | | | | | | | | 1 | |
| **CO2** | 2 | 2 | 3 | | | | | | | | | | 2 | |
| **CO3** | | 3 | 2 | | 3 | | | | | | | | 2 | 1 |

The strength of mapping is to be written as 1: Low, 2: Medium, 3: High
Each CO of the course must map to at least one PO.

**Assessment**

The assessment is based on MSE, ISE and ESE.
MSE shall be typically on modules 1 to 3.
ISE shall be taken throughout the semester in the form of teacher’s assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO.
ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6.
For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

# Walchand College of Engineering, Sangli
*(Government Aided Autonomous Institute)*

## AY 2022-23

### Course Information

| | |
|---|---|
| **Programme** | B.Tech. (Computer Science and Engineering) |
| **Class, Semester** | Final Year B. Tech., Sem VIII |
| **Course Code** | 5CS434 |
| **Course Name** | Elective-8: MOOC Course on Social Networks |
| **Desired Requisites:** | Discrete Mathematics and Linear Algebra, Programming and Algorithms |

| **Teaching Scheme** | | **Examination Scheme (Marks)** | | | |
|---|---|---|---|---|---|
| **Lecture** | 3 Hrs/week | **MSE** | **ISE** | **ESE** | **Total** |
| **Tutorial** | - | 30 | 20 | 50 | 100 |
| | | **Credits: 3** | | | |

### Course Objectives

| | |
|---|---|
| **1** | To provide knowledge of the basics of social networks. |
| **2** | To describe various social network algorithms. |
| **3** | To demonstrate social network analysis applicable to real world data, with examples from today's most popular social networks |
| **4** | To understand real world problems for social network |

### Course Outcomes (CO) with Bloom's Taxonomy Level

At the end of the course, the students will be able to,

| **CO** | **Course Outcome Statement/s** | **Bloom's Taxonomy Level** | **Bloom's Taxonomy Description** |
|---|---|---|---|
| **CO1** | Describe basic characteristics of social network and social network analysis | II | Understand |
| **CO2** | Illustrate different social network analyzing algorithms and concepts | III, IV | Apply,Analyze |
| **CO3** | Evaluate different social networks with the help of real time datasets | V | Evaluate |
| **CO4** | Create social network for real world problems | VI | Create |

| **Module** | **Module Contents** | **Hours** |
|---|---|---|
| I | **Introduction**<br>Introduction to networkx, challenges of social networks, Searching in a network, link prediction, the contagions, Importance of acquaintances, marketing on social networks, handling real world network datasets. | 8 |
| II | **Strength of weak ties and homophily**<br>Granovetter's Strength of weak ties, Triads, Clustering coefficient and neighborhood overlap, Structure of weak ties bridges and local bridges, Embedeness, structural holes, Social capital, Finding communities in a graph, Foci closure membership closure. | 6 |
| III | **Positive negative relationships and link analysis**<br>Structural balance, Characterising the structure of a balanced network, Balance theorem and its proof, Introduction to positive and negative edges, the web graph, collecting the web graph, equal coin distribution, random coin dropping, Introduction to hubs and authorities. | 6 |
| IV | **Cascading Behaviors in networks**<br>Diffusion in networks, modelling diffusion, impact of communities on diffusion, Cascade and clusters. | 6 |

| | | |
|---|---|---|
| V | **Richer get richer phenomenon**<br>Introduction to powerlaw, detection of powerlaw, forced vs random removal of nodes, richer ger richer phenomenon, epidemics, spreading models, percolation models. | 7 |
| VI | **Small world effect**<br>Small world effect, milgram's experiment, Generative model and decentralised search, how to go viral on web. | 7 |

**Textbooks**

| | |
|---|---|
| 1 | Matthew A. Russell. Mining the Social Web: Data Mining Facebook, Twitter, Linkedin, Google+, Github, and More, 2nd Edition, O'Reilly Media, 2013. |
| 2 | Jennifer Golbeck, Analyzing the social web, Morgan Kaufmann, 2013. |

**References**

| | |
|---|---|
| 1 | Charu Aggarwal (ed.), Social Network Data Analytics, Springer, 2011. |

**Useful Links**

| | |
|---|---|
| 1 | https://nptel.ac.in/courses/106106169 |
| 2 | http://cse.iitkgp.ac.in/~pawang/courses/SC16.html |

**CO-PO Mapping**

| | Programme Outcomes (PO) | | | | | | | | | | | | PSO | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| **CO1** | | 1 | | | | | | | | | | | 2 | |
| **CO2** | 1 | | | | | | | | | | | | 3 | |
| **CO3** | 3 | 3 | | | | | | | | | | | | 3 |
| **CO4** | | 2 | | | | | | | | | | | | 1 |

The strength of mapping is to be written as 1: Low, 2: Medium, 3: High
Each CO of the course must map to at least one PO.

**Assessment**

The assessment is based on MSE, ISE and ESE.
MSE shall be typically on modules 1 to 3.
ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO.
ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6.
For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

| Walchand College of Engineering, Sangli<br>*(Government Aided Autonomous Institute)* | | | | | |
|---|---|---|---|---|---|
| **AY 2022-23** | | | | | |
| **Course Information** | | | | | |
| **Programme** | | B.Tech. (Computer Science and Engineering) | | | |
| **Class, Semester** | | Final Year B. Tech., Sem VIII | | | |
| **Course Code** | | 5CS435 | | | |
| **Course Name** | | Elective-8: MOOC Course on Virtual Reality | | | |
| **Desired Requisites:** | | Nil | | | |
| | | | | | |
| **Teaching Scheme** | | **Examination Scheme (Marks)** | | | |
| **Lecture** | 3 Hrs/week | **MSE** | **ISE** | **ESE** | **Total** |
| **Tutorial** | - | 30 | 20 | 50 | 100 |
| | | **Credits: 3** | | | |

| **Course Objectives** | |
|---|---|
| **1** | To inculcate understanding of detailed functions of VR and different VR techniques |
| **2** | To illustrate working of different VR designs and different VR techniques |
| **3** | To emphasize on VR evaluation and Implementation techniques |

**Course Outcomes (CO) with Bloom's Taxonomy Level**

At the end of the course, the students will be able to,

| CO | Course Outcome Statement/s | Bloom's Taxonomy Level | Bloom's Taxonomy Description |
|---|---|---|---|
| **CO1** | Describe working of VR and VR basics. | II | Understand |
| **CO2** | Illustrate various VR design principals | III | Apply |
| **CO3** | Comprehend strengths and weaknesses of VR design techniques and use appropriate VR technique as per real life | IV | Analyze |
| **CO4** | | | |

| Module | Module Contents | Hours |
|---|---|---|
| I | **Introduction**<br>Course mechanics, Goals and VR definitions, Historical perspective, Birds-eye view (general), Birds-eye view (general), Birds-eye view (hardware), Birds-eye view (software) 8. Birds-eye view (sensation and perception) | 4 |
| II | **Geometry of Virtual Worlds**<br>Geometric modeling, Transforming models, Matrix algebra and 2D rotations, 3D rotations and yaw, pitch, and roll, 3D rotations and yaw, pitch, and roll, contd, Axis-angle representations, Quaternions, Converting and multiplying rotations, Converting and multiplying rotations, contd, Homogeneous transforms, The chain of viewing transforms, Eye transforms, Canonical view transform, Viewport transform | 5 |
| III | **Light and Optics**<br>Three interpretations of light, Refraction, Simple lenses, Diopters, Optical system of eyes | 5 |
| IV | **Visual Physiology**<br>Photoreceptors, Sufficient resolution for VR, Light intensity, Eye movements | 4 |
| V | **Visual Perception**<br>Depth perception, Depth perception, Motion perception, Frame rates and displays, Frame rates and displays | 4 |
| VI | **Tracking Systems**<br>Overview, Orientation tracking, Tilt drift correction, Tracking with a camera, Perspective n-point problem, Filtering | 4 |

| Textbooks | |
|---|---|
| 1 | Doug A. Bowman,Ernst Kruijff, Joseph J. LaViola, and Ivan Poupyrev, 3D User Interfaces, AddisonWesley, 2005 |
| 2 | K.S. Hale and K. M.Stanney, Handbook on Virtual Environments, 2nd edition, CRC Press, 2015 |
| | |
| **References** | |
| 1 | George Mather, Foundations of Sensation and Perception:Psychology Press; 2 edition, 2009 |
| 2 | Peter Shirley, MichaelAshikhmin, and Steve Marschner, Fundamentals of Computer Graphics,A K Peters/CRC Press; 3 edition, 2009 |
| | |
| **Useful Links** | |
| 1 | http://msl.cs.uiuc.edu/vr/ |
| 2 | http://nptel.iitm.ac.in/ |

| CO-PO Mapping | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Programme Outcomes (PO)** | | | | | | | | | | | **PSO** | |
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| **CO1** | | 1 | | | | | | | | | | | 1 | |
| **CO2** | 2 | 2 | 3 | | | | | | | | | | 2 | |
| **CO3** | | 3 | 2 | | 3 | | | | | | | | 2 | 1 |

The strength of mapping is to be written as 1: Low, 2: Medium, 3: High
Each CO of the course must map to at least one PO.

## Assessment

The assessment is based on MSE, ISE and ESE.
MSE shall be typically on modules 1 to 3.
ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO.
ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6.
For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

## Walchand College of Engineering, Sangli
*(Government Aided Autonomous Institute)*

**AY 2022-23**

| Course Information | |
|---|---|
| **Programme** | B.Tech. (Computer Science and Engineering) |
| **Class, Semester** | Final Year B. Tech., Sem VIII |
| **Course Code** | 5CS436 |
| **Course Name** | Elective-8: MOOC Course on Blockchain and Its applications |
| **Desired Requisites:** | Computer Networks; Operating Systems; Cryptography and Network Security. |

| Teaching Scheme | | Examination Scheme (Marks) | | | |
|---|---|---|---|---|---|
| **Lecture** | 3 Hrs/week | **MSE** | **ISE** | **ESE** | **Total** |
| **Tutorial** | - | 30 | 20 | 50 | 100 |
| | | **Credits: 3** | | | |

| Course Objectives | |
|---|---|
| **1** | Inculcate how blockchain systems (mainly Bitcoin and Ethereum) work, |
| **2** | Illustrate process of Design, build, and deploy smart contracts and distributed applications, |
| **3** | Inculcate how to Integrate ideas from blockchain technology into their own projects. |

**Course Outcomes (CO) with Bloom's Taxonomy Level**

At the end of the course, the students will be able to,

| CO | Course Outcome Statement/s | Bloom's Taxonomy Level | Bloom's Taxonomy Description |
|---|---|---|---|
| **CO1** | Describe basic principles of Blockchain | II | Understand |
| **CO2** | Illustrate the different techniques used in Blockchain | III | Apply |
| **CO3** | Analyse different Designs, security, privacy, and efficiency of a given blockchain system. | IV | Analyse |
| **CO4** | | | |

| Module | Module Contents | Hours |
|---|---|---|
| I | Introduction to Blockchain Technology and its Importance | 4 |
| II | Basic Crypto Primitives<br>Cryptographic Hash, Digital Signature | 7 |
| III | Evolution of the Blockchain Technology, Elements of a Blockchain | 8 |
| IV | Blockchain Consensus<br>Permissionless Models, Permissioned Models | 7 |
| V | Smart Contract Hands On and Decentralized Identity Management<br>Ethereum Smart Contracts (Permissionless Model), Hyperledger Fabric (Permissioned Model) | 8 |
| VI | Blockchain Interoperability and Applications | 5 |

| Textbooks | |
|---|---|
| 1 | Mastering Blockchain: A deep dive into distributed ledgers, consensus protocols, smart contracts, DApps, cryptocurrencies, Ethereum, and more, 3rd Edition, Imran Bashir, Packt Publishing, 2020, ISBN: 9781839213199, book website: https://www.packtpub.com/product/mastering-blockchain-third-edition/9781839213199 |

| References | |
|---|---|
| 1 | NPTEL course on Blockchain and its applications |
| 2 | Hyperledger Tutorials - https://www.hyperledger.org/use/tutorials |
| 3 | Ethereum Development Resources - https://ethereum.org/en/developers |

| Useful Links | |
|---|---|
| 1 | https://onlinecourses.nptel.ac.in/noc22_cs44/preview |

| CO-PO Mapping | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Programme Outcomes (PO) | | | | | | | | | | | | PSO | |
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| **CO1** | 2 | | | | | | | | | | | | 1 | |
| **CO2** | | 1 | | | | | | | | | | | 1 | |
| **CO3** | | | 2 | | | | | | | | | | 1 | |
| The strength of mapping is to be written as 1: Low, 2: Medium, 3: High<br>Each CO of the course must map to at least one PO. | | | | | | | | | | | | | | |

| Assessment |
|---|
| The assessment is based on MSE, ISE and ESE.<br>MSE shall be typically on modules 1 to 3.<br>ISE shall be taken throughout the semester in the form of teacher’s assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO.<br>ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6.<br>For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing) |

# Walchand College of Engineering, Sangli

*(Government Aided Autonomous Institute)*

## AY 2022-23

| Course Information | |
|---|---|
| **Programme** | B.Tech. (Computer Science and Engineering) |
| **Class, Semester** | Final Year B. Tech., Sem VIII |
| **Course Code** | 5CS437 |
| **Course Name** | Elective 8 : MOOC Course on Computing: Introduction to parallel programming with OpenMP and MPI |
| **Desired Requisites:** | Programming in C. |

| **Teaching Scheme** | | **Examination Scheme (Marks)** | | | |
|---|---|---|---|---|---|
| **Lecture** | 3 Hrs/week | **MSE** | **ISE** | **ESE** | **Total** |
| **Tutorial** | - | 30 | 20 | 50 | 100 |
| | | **Credits: 3** | | | |

| **Course Objectives** | |
|---|---|
| **1** | To introduce concepts & programming principles involved in developing scalable parallel applications |
| **2** | To apply knowledge of writing scalable programs for multi-core architectures using OpenMP and C. |
| **3** | To analyze parallel architecture and discuss the performance metrics of HPC programs. |

**Course Outcomes (CO) with Bloom's Taxonomy Level**

At the end of the course, the students will be able to,

| **CO** | **Course Outcome Statement/s** | **Bloom's Taxonomy Level** | **Bloom's Taxonomy Description** |
|---|---|---|---|
| **CO1** | To introduce the concepts of high performance computing (HPC) to science and engineering students | II | Understanding |
| **CO2** | To apply different parallel computing tools like MPI, OpenMP and CUDA will be used in connection with domain specific problems. | III | Applying |
| **CO3** | To apply knowledge of Multi-CPU computing using both distributed and shared memory architecture using OpenMP and MPI based parallelization. | III | Applying |
| **CO4** | | | |

| **Module** | **Module Contents** | **Hours** |
|---|---|---|
| I | Single Processor Architecture and Basic OpenMP Constructs and Functions, More OpenMP constructs & functions | 8 |
| II | Basic Linear Algebra using OpenMP and OpenMP tasks | 8 |
| III | Critical Sections, locks and Matrix Factorization using OpenMP | 7 |
| IV | Distributed Memory programming and Message Passing Interface (MPI) | 6 |
| V | MPI Collectives and Interconnection architectures, Some applications on distributed memory architectures | 7 |
| VI | Applications to Graph Algorithms | 5 |

| **Textbooks** | |
|---|---|
| 1 | Ananth Grama, Anshul Gupta, George Karypis, Vipin Kumar, "Introduction to Parallel Computing", Addison-Wesely, 2nd Edition, 2003 |

| **References** | |
|---|---|
| 1 | Grama, A., Gupta, A., Karypis, G., and Kumar, V., Introduction to Parallel Computing, Addison Wesley, 2003 |

| | |
|---|---|
| 2 | Gropp, W, Ewing L, and Anthony S. Using MPI: portable parallel programming with the message-passing interface. Vol. 1. MIT press, 1999. |
| 3 | Cook, S., CUDA Programming: A Developer's Guide to Parallel Computing with GPUs, M K Publishers, 2012 NVIDIA, CUDA C Programming guide, 2012 |
| | |
| **Useful Links** | |
| 1 | https://onlinecourses.nptel.ac.in/noc20_me61/preview |
| 2 | OpenMP Tutorial from LLNL (https://computing.llnl.gov/tutorials/openMP |

| **CO-PO Mapping** | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Programme Outcomes (PO)** | | | | | | | | | | | | **PSO** | |
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| **CO1** | 2 | | | | | | | | | | | | 1 | 1 |
| **CO2** | | 3 | | | | | | | | | | | 3 | 1 |
| **CO3** | | 2 | 2 | | | | | | | | | | 2 | 1 |
| The strength of mapping is to be written as 1: Low, 2: Medium, 3: High<br>Each CO of the course must map to at least one PO. | | | | | | | | | | | | | | |

| **Assessment** |
|---|
| The assessment is based on MSE, ISE and ESE.<br>MSE shall be typically on modules 1 to 3.<br>ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO.<br>ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6.<br>For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing) |

| Walchand College of Engineering, Sangli<br>*(Government Aided Autonomous Institute)* | |
|---|---|
| **AY 2022-23** | |
| **Course Information** | |
| **Programme** | B.Tech. (Computer Science and Engineering) |
| **Class, Semester** | Final Year B. Tech., Sem VIII |
| **Course Code** | 5CS438 |
| **Course Name** | Elective 9 - Advanced Machine Learning |
| **Desired Requisites:** | Introduction to Machine Learning |

| **Teaching Scheme** | | **Examination Scheme (Marks)** | | | |
|---|---|---|---|---|---|
| **Lecture** | 3 Hrs/week | **MSE** | **ISE** | **ESE** | **Total** |
| **Tutorial** | - | 30 | 20 | 50 | 100 |
| | | **Credits: 3** | | | |

| **Course Objectives** | |
|---|---|
| **1** | Introduces various mathematical concepts required for machine learning. |
| **2** | Understand GAN components, build basic GANs using PyTorch and advanced DCGANs using convolutional layers, control your GAN and build conditional GAN |

**Course Outcomes (CO) with Bloom's Taxonomy Level**

At the end of the course, the students will be able to,

| **CO** | **Course Outcome Statement/s** | **Bloom's Taxonomy Level** | **Bloom's Taxonomy Description** |
|---|---|---|---|
| **CO1** | Explain advanced mathematical concept required for machine learning | II | Understand |
| **CO2** | Understand the intuition behind the fundamental components of Transformers and Recommender system | II | Understand |
| **CO3** | Implement case studies on GAN, Transformers and Recommender systems. | III | Apply |
| **CO4** | Build conditional GANs capable of generating examples from determined categories | VI | Create |

| **Module** | **Module Contents** | **Hours** |
|---|---|---|
| I | **Introduction**<br>Backpropagation and automatic differentiation, Machine learning frameworks I: the user interface, Overfitting, Generalization error, Early stopping, Our first hyperparameters: step size/learning rate, minibatch size, Regularization, Application-specific forms of regularization, The condition number, Momentum and acceleration, Momentum for quadratic optimization, Momentum for convex optimization. | 8 |
| II | **Intro to GANs and Deep Convolutional GAN**<br>Learn about GANs and their applications, understand the intuition behind the basic components of GANs, and build your very own GAN using PyTorch, Build a more sophisticated GAN using convolutional layers. Learn about useful activation functions, batch normalization, and transposed convolutions to tune your GAN architecture and apply them to build an advanced DCGAN specifically for processing images. | 6 |

| | | |
|---|---|---|
| III | **Specialized GANs**<br>**Wasserstein GANs with Normalization:** Reduce instances of GANs failure due to imbalances between the generator and discriminator by learning advanced techniques such as WGANs to mitigate unstable training and mode collapse with a W-Loss and an understanding of Lipschitz Continuity.<br><br>**Conditional and Controllable GANs:** Understand how to effectively control your GAN, modify the features in a generated image, and build conditional GANs capable of generating examples from determined categories. | 8 |
| IV | **Transformers**<br>Motivation, attention models, architecture types, BERT, Roberta, Albert | 6 |
| V | **Recommender System**<br>Collaborative filtering, content-based filtering | 6 |
| VI | **Case Studies** on GANs, Transformers and Recommender Systems | 6 |

| **Textbooks** | |
|---|---|
| 1 | Jacub langr, "GANs in Action: Deep learning with Generative Adversarial Networks" 1st Edition |

| **References** | |
|---|---|
| 1 | |

| **Useful Links** | |
|---|---|
| 1 | https://nptel.ac.in/courses/106/106/106106198/ |
| 2 | https://www.cs.cornell.edu/courses/cs6787/2019fa/ |
| 3 | https://www.deeplearning.ai/program/generative-adversarial-networks-gans-specialization/ |

**CO-PO Mapping**

| | **Programme Outcomes (PO)** | | | | | | | | | | | | **PSO** | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| **CO1** | 3 | | | | | | | | | | | | | |
| **CO2** | | | | | 3 | | | | | | | | | |
| **CO3** | | | 1 | | 2 | | | | | | | | | |
| **CO4** | | | 1 | | 2 | | | | | | | | | |

The strength of mapping is to be written as 1: Low, 2: Medium, 3: High
Each CO of the course must map to at least one PO.

**Assessment**

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ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6.
For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

# Walchand College of Engineering, Sangli

*(Government Aided Autonomous Institute)*

## AY 2022-23

| Course Information | |
|---|---|
| **Programme** | B.Tech. (Computer Science and Engineering) |
| **Class, Semester** | Final Year Sem VIII |
| **Course Code** | 5CS439 |
| **Course Name** | Elective 9- Big Data Computing |
| **Desired Requisites:** | Data Structure & Algorithms, Computer Architecture, Operating System, Database Management Systems |

| **Teaching Scheme** | | **Examination Scheme (Marks)** | | | |
|---|---|---|---|---|---|
| **Lecture** | 3 Hrs/week | **MSE** | **ISE** | **ESE** | **Total** |
| **Tutorial** | - | 30 | 20 | 50 | 100 |
| | | **Credits: 3** | | | |

| **Course Objectives** | |
|---|---|
| **1** | To explain the fundamentals of Big data computing problems, applications and characteristics. |
| **2** | To discuss various enabling, storage and streaming ways of Big Data |
| **3** | To present Machine learning techniques for Big Data |

**Course Outcomes (CO) with Bloom's Taxonomy Level**

At the end of the course, the students will be able to,

| **CO** | **Course Outcome Statement/s** | **Bloom's Taxonomy Level** | **Bloom's Taxonomy Description** |
|---|---|---|---|
| **CO1** | Illustrate fundamentals of Big data computing terminology | II | Understanding |
| **CO2** | Demonstrate various Big Data enabling techniques | IV | Analyze |
| **CO3** | Discuss various Big data storage and streaming platform. | III | Apply |

| **Module** | **Module Contents** | **Hours** |
|---|---|---|
| I | **Introduction to Big Data**<br>Why Big data computing, where did it come from, big data problems, applications, Characteristics. | 5 |
| II | **Introduction to Enabling Technologies for Big Data**<br>Brief introduction of big data enabling techniques Hadoop HDFC, Hadoop YARN MapReduce, Apache Cassandra, HBase, Big Data Streaming Platforms: Apache Spark Streaming, Apache Kafka | 7 |
| III | **Hadoop For Big Data**<br>Hadoop distribution file system (HDFS), Goal of Hadoop, read/write process of HDFS, Main configuration tuning parameters to control HDFS performance and robustness, Hadoop 1.0, Hadoop 2.0 | 7 |
| IV | **Spark**<br>Overview of spark, fundamentals of scala & functional programming, spark concepts. Spark operations, Job execution. | 6 |
| V | **Introduction to Big Data Storage Platforms for Large Scale Data Storage**<br>Data placement strategies, CAP theorem, Consistency solution, Design of Zookeeper, Cassandra Query Language. HBase | 7 |
| VI | **Big Data Streaming Platforms and Performance engine**<br>Real-time Big data processing with Spark streaming and sliding window analytics, Big data performance engine | 8 |

| **Textbooks** | |
|---|---|
| 1 | |

| | |
|---|---|
| **References** | |
| 1 | NPTEL Course Big Data Computing, IIT Patna Dr. Rajiv Misra |
| | |
| **Useful Links** | |
| 1 | *https://nptel.ac.in/courses/106104189* |

**CO-PO Mapping**

| | Programme Outcomes (PO) | | | | | | | | | | | | PSO | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| **CO1** | 2 | | | | | | | | | | | | | |
| **CO2** | 2 | 2 | | | | | | | | | | | | |
| **CO3** | 2 | 3 | | | | | | | | | | | | |
| **CO4** | | | | | | | | | | | | | | |

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Each CO of the course must map to at least one PO.

**Assessment**

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ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6.
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