

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. Shashi 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:

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

Course Objectives :

- To make student familiar with engineering properties associated with different materials to use them successfully in practice.
- 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 :

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

- 1:** Explain and select chemical method of analysis.
- 2:** Decide suitability of available water towards various industrial applications.
- 3:** Describe one and two component systems and terms associated with respect to heterogeneous systems.
- 4:** Describe and determine calorific value by different methods. Solve combustion related problems
- 5:** Compare and contrast different modern analysis techniques
- 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.

Assessments for Computer Science and Engineering Marks

ISE 1

10

25

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 60-70% weightage for course content (normally last three modules) covered after MSE.

Course Contents:

Module 1 : Matrices 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 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 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 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 Exact, Linear, Bernoulli's equations, Euler's equations, Orthogonal trajectory, applications to simple electric circuit.	8Hrs.
Module 6: Curve tracing 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
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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
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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 with 70-80% weightage for course content (normally last three modules) covered after MSE.

Course Contents:	
Module 1 Introduction to Civil Engineering	Hrs.
<p>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</p> <p>Early constructions and developments over time; ancient monuments & modern marvels; works of eminent civil engineers</p> <p>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,</p>	6
<p>Module 2 Fundamentals of Building Materials and Principles</p> <p>Properties and uses of basic materials: cement, bricks, stone, timber, natural and artificial sand, steel, concrete, PCC, RCC, brick masonry.</p> <p>Buildings-selection of site, types and basic functions. Basics of soil mechanics, various types of foundations.</p> <p>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.</p> <p>Introduction to smart cities</p>	6
<p>Module 3 Basics of Construction Management & Structural Engineering</p> <p>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</p> <p>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</p>	5
<p>Module 4 Infrastructure</p> <p>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.</p> <p>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</p> <p>Dams: purpose, selection of site, types of dams.</p>	6
<p>Module 5 Environmental Engineering & Sustainability</p> <p>Water and Wastewater treatment systems; municipal and hazardous solid waste management; sustainability in construction;</p>	3
<p>Module 6 Property Transaction</p> <p>Land documents, property purchase and sale procedure. property selection criteria and marketability of property transaction , property taxes; introduction to building finance</p>	2
<p>Module wise Measurable Students Learning Outcomes : After the completion of the course the student should be able to:</p> <ol style="list-style-type: none"> Paraphrase and apply fundamental knowledge of civil Engineering and use of modern surveying Instrument. Explain basic principles of planning and bye Laws. Evaluate various properties of building 	

materials.

3. **Explain** construction Management and Structural Engineering
4. **Perceive and Summarize the need** of infrastructure development India.
5. **Explain** the importance of water treatment plant and solid waste management.
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. 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; Problems from the above units should also be practiced on computer aided drafting software.	
Module 2: Orthographic Projections	Hrs. 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; 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. 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. 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) Problems from the above units should also be practiced on computer aided drafting software.	
Module 4: Isometric Projections	Hrs. 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; Problems from the above units should also be practiced on computer aided drafting software.	
Module 5: Introduction to Computer Aided Sketching	Hrs. 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. 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;	
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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, 11th 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 interrelationships among the living organisms.

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 with 60-70% weightage for course content (normally three modules) covered after MSE.

Course Contents:

Module 1 : Introduction and Classification	H
Introduction: History and Significance of Biology. Evolution: Origin of life; Biological evolution. 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	H
Cell theory and cell as the basic unit of life: Structure of Prokaryotic (Typical Bacterial Cell) and Eukaryotic cell (Plant cell and animal cell) 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. Cell division: Cell cycle, mitosis, meiosis and their significance.	0
Module 3 : Genetics	H
Introduction: Chromosomes, DNA, RNA, Genes, Genetics, Transcription and Translation in prokaryotic and eukaryotic cell Inheritance: Mechanisms of inheritance, Unifactorial Inheritance, Multifactorial inheritance, Sex-linked Inheritance.	0
Module 4 : Macromolecular Analysis and Protein Structure	H
Biomolecules: Structure and function of proteins (primary secondary, tertiary and quaternary structure), carbohydrates, lipid, nucleic acids; Enzymes: Types, properties, enzyme action: - Lock and Key hypothesis, Induced fit hypothesis.	0
Module 5 :Bioenergetics and Metabolism	H
Bioenergetics: Thermodynamics –First law of thermodynamics, second law of thermodynamics, Gibbs free energy, endergonic & exergonic reactions, ATP: Structure, properties and energy currency of the cell. Introduction to Metabolism - Catabolism, anabolism, catabolic, anabolic and amphibolic pathways 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. 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. 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	H
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 interrelationships among the living organisms 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 with 70-80% weightage for course content (normally last three modules) covered after MSE.

Course Contents:

Module 1: Introduction 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 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 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 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 1. Smart Materials-Introduction, Classification, Types, Applications. 2. Bio Materials- Introduction, Classification, Types, Applications. 3. Materials for sports- Introduction, Classification, Types, Applications. 4. Meta materials- Introduction, Classification, Types, Applications.	4 Hrs.
Module 6: Economic, Environmental and Social Issues in Material Science and Engineering 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", Macmillan 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 Geology", 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 & Distributors, 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: <u>Geology and Geotectonics:</u> 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 Isostasy, continental drift and plate tectonics. orogeny and epirogeny, types of mountains.	5 Hrs.
Module 2: <u>Mineralogy and Petrology:</u> 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: <u>Structural Geology and Palaeontology:</u> 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: <u>Economic Geology(Metals):</u> 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: <u>Economic Geology(Non-metals):</u> 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 : <u>Introduction to Indian Stratigraphy:</u> Physiographic divisions of India and their characteristics, Rivers and mountains of India, Principles of stratigraphy, 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, 11th 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 with 60-70% 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 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. 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. 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. 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, 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). Application of Biotechnology in health and agriculture: Production of secondary metabolites/products, Insulin, growth hormones: Indol acetic acid, interferons. Methods of gene transfer in plants, improvement. Introduction to transgenics: gene therapy, Genetically modified organisms 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. 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, 6th 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).	
2. Estimation of alkalinity of water (Neutralization Titration).	
3. Estimation of Dissolved Oxygen in water (Iodometric Titration).	
4. Estimation of Chloride content in water (Argentometry).	
5. Demonstration of pH meter & pH metric titration.	
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 determination reduced 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 to	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:

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

Course Objectives:

- To provide basic concepts to solve many engineering and technical issues.
- To give deep insights into the understanding of engineering courses.
- 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.	
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Module 6: Computer Instrumentation	6Hrs.
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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.	
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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

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 60-70% weightage for course content (normally last three modules) covered after MSE.

Course Contents:

Module 1: Beta-Gamma Functions: Definition of Beta, Gamma functions and properties of Beta Gamma functions.	5Hrs.
Module 2: Multivariable Calculus: 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: 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: Introduction, Sample Space, Events, Axioms of probability, Conditional probability Baye's Theorem.	6 Hrs.
Module 5: Statistics: Correlation, Linear Regression, Curve-fitting: (a) straight Line (b) parabolic curve (c) exponential curve (d) logarithmic curve.	6 Hrs.
Module 6: Probability Distribution: 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, 2nd 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 with 60-70% 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. Mittal 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 with 70-80% 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	Hrs.
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	<i>L</i>	<i>T</i>	<i>P</i>	<i>Cr</i>
Course Code :	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**

1. Subject Verb Agreement
2. Modal verbs
3. Question tags
4. Connectives

5Hrs.

5. Synonyms, Antonyms, and Standard abbreviations
6. Redundancies
7. Misplaced Modifiers
8. Passives

Module 2 : Fundamentals of Communication

1. Features and Functions
2. Importance of Communication
3. The Communication Process
4. Barriers and Breakdown of Communication
5. Communication in an Organization
 - i. Upward communication
 - ii. Downward communication
 - iii. Horizontal communication
 - iv. Diagonal communication
 - v. Informal communication / Grapevine communication

3Hrs.**Module 3 : Nature and Style of Writing**

1. Describing
2. Defining
3. Classifying
4. Providing examples or evidence
5. Writing Introduction and Conclusion

3Hrs.**Module 4 :****A. Non Verbal Communication**

1. Kinesics or Body Language
2. Proxemics : Space Distance
3. Haptic
4. Vocalic : Paralinguistic features

2Hrs.

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

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:

- Halliday, Resnic and Walker, “**Fundamentals of Physics**”, John Wiley, 9th edition 2011.
- A. Beiser, “**Concepts of Modern Physics**”, McGraw Hill International, 5th edition, 2003.
- Ajoy Ghatak, “**Optics**”, Tata McGraw Hill 5th edition, 2012.

Course Objectives:

- To gain practical knowledge by applying the experimental methods to correlate with the Physics theory.
- To learn the usage of electrical and optical systems for various measurements.
- 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 (Minimum 8 experiments from the following list)	2 Hrs. each Expt.
1. Find the diameter of the thin wire by diffraction of the light	
2. Determination of wavelength of light by plane diffraction grating.	
3. Determine the Specific rotation of sugar solution	
4. Find the wavelength of He-Ne Laser using Plane diffraction grating.	
5. Find the e/m for the cathode rays	
6. Verify the expression for the resolving power of a telescope.	
7. Measure the wavelength of ultrasonic waves by Kundt's tube method.	
8. Design and simulate Colpitt's & Hartley Oscillator.	
9. Determine the Planck's constant.	
10. Find the wavelength and velocity of ultrasonic waves in liquid.	
11. Study the I-V characteristic of semiconductor diode.	
12. Newton's ring: Determination of wavelength of light and refractive index of liquid.	

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.
<p>Introduction to Programming (Flow chart/pseudocode, compilation etc.), Constants, Variables (including data types).</p> <p>Assignments:</p> <p>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.</p> <ol style="list-style-type: none"> 1. Familiarization with programming environment IDE (Integrated development environment). 2. Draw flowchart, Write an algorithm for real world problem. <ol style="list-style-type: none"> 1. Programs to display different data type value and size. 2. Programs to demonstrate different operators and their order precedence. 	
Module 2: Arithmetic expressions and precedence	7 Hrs.
<p>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.</p> <p>Assignments:</p> <ol style="list-style-type: none"> 1. Programs to solve simple computational problems using arithmetic expressions e.g. simple and compound interest. 	
Module 3: Conditional Branching and Loops	8 Hrs.
<p>Statements and blocks, if and switch statements, Loops- while, do-while and for statements, break, continue, goto and labels.</p> <p>Assignments:</p> <ol style="list-style-type: none"> 1. Programs to demonstrate problems on conditional branching e.g. roots of quadratic equation, finding a maximum/minimum value. 2. Programs to show statement block, conditional statement. 3. Programs to show different types of iteration / loop. 4. Implementation of iterative problems e.g., sum of series. 	
Module 4: Arrays, Functions and Recursion	10 Hrs.
<p>Arrays- concepts, declaration, definition, accessing elements, storing elements, arrays and functions, two-dimensional arrays, applications of arrays.</p> <p>Designing structured programs, Functions basics, parameter passing, storage classes like extern, auto, register, static, scope rules, block structure, user defined functions, Recursion with examples</p> <p>Assignments:</p> <ol style="list-style-type: none"> 1. Programs to demonstrate matrix problems, string operations, sorting problems. 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.
<p>Pointers- concepts, initialization of pointer variables, pointers and function arguments, address arithmetic, Character pointers and functions, pointers to pointers.</p> <p>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.</p> <p>Assignments:</p>	

1. Programs to illustrate use of pointer with simple data type (create pointer variable, assign value, access value and show address using (* and &).
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.

Assignments:

1. File handling: Study and implementation file operations.
2. Programs to demonstrate simple read and write operation on the external text file.
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.	<i>II</i>	Application
CO2	construct digital IC, diode and op-amp based circuits.	<i>III</i>	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)

- 1) Identification of components and instruments required in lab to perform experiments based on Electronics.
- 2) Verification of truth table of all logic gates.
- 3) Realization of logic gates using basic building block (NAND/NOR).
- 4) Implementation of combinational logic circuit.
- 5) Study of P-N Junction diode characteristics
- 6) Working of Half-wave rectifiers
- 7) Working of Full-wave rectifiers
- 8) Working of clipper
- 9) Working of clampers
- 10) Study of transistor as a switch and amplifier (BJT and JFET)
- 11) Study of inverting and non-inverting amplifier (IC 741)
- 12) Implementation of opamp based application (Adder / Subtractor)
- 13) Working of multivibrator using IC 555 (Astable and Monostable)

Measurable Students Learning Outcomes based on above experiments:

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

- 1) identify and handle electronic components, ICs and instruments
- 2) implement and test diode, transistor and opamp based circuits
- 3) identify use of diode, transistor and opamp in various applications
- 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.



**WALCHAND COLLEGE OF ENGINEERING
SANGLI**

(An Autonomous Institute)

**Curriculum (Structure and Syllabus)
for
Second Year B.Tech
Computer Science and Engineering
Academic Year 2019-2020**



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	Min for Passing	
BS	4CS201	Applied Mathematics for Computer Science and Engineering	3	0	0	3	ISE 1	10	20	40
							MSE	30		
							ISE 2	10		
							ESE	50		
HS	4HS203	Environmental Science	2	1	0	3	ISE 1	10	20	40
							MSE	30		
							ISE 2	10		
							ESE	50		
PC	4CS202	Discrete Mathematics	3	1	0	4	ISE 1	10	20	40
							MSE	30		
							ISE 2	10		
							ESE	50		
PC	4CS203	Data Structures	3	0	0	3	ISE 1	10	20	40
							MSE	30		
							ISE 2	10		
							ESE	50		
PC	4CS204	Data Communication	3	0	0	3	ISE 1	10	20	40
							MSE	30		
							ISE 2	10		
							ESE	50		
PC	4CS205	Computer Organization and Architecture	3	0	0	3	ISE 1	10	20	40
							MSE	30		
							ISE 2	10		
							ESE	50		
PC	4CS251	Data Structures Laboratory	0	0	2	1	ISE	50	20	20
							ESE	50	20	
PC	4CS252	Computer Organization and Architecture Laboratory	0	0	2	1	ISE	50	20	20
							ESE	50	20	
PC	4CS253	Programming Laboratory I	0	0	4	2	ISE	50	20	20
							ESE	50	20	
Total			17	2	8	23	Total Credits: 23 Total Contact Hrs.: 27			

Aaulas
Ms. A.S. Pawar

B. F. Momin
01/06/19

DR. B. F. MOMIN

Associate Professor & Head
Dept. of Computer Science & Engineering
Walchand College of Engineering, Sangli



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	
PC	4CS221	Software Engineering	3	0	0	3	ISE 1	10	40
							MSE	30	
							ISE 2	10	
							ESE	50	
PC	4CS222	Formal Language and Automata Theory	3	1	0	4	ISE 1	10	40
							MSE	30	
							ISE 2	10	
							ESE	50	
PC	4CS223	Operating Systems	3	0	0	3	ISE 1	10	40
							MSE	30	
							ISE 2	10	
							ESE	50	
PC	4CS224	Database Engineering	3	0	0	3	ISE 1	10	40
							MSE	30	
							ISE 2	10	
							ESE	50	
PC	4CS225	Computer Network	3	0	0	3	ISE 1	10	40
							MSE	30	
							ISE 2	10	
							ESE	50	
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 Total Contact Hrs.: 26		

Ms. A. S. Pawar

Dr. B. F. Momin
20/10/19

DR. B. F. MOMIN
Associate Professor & Head
Dept. of Computer Science & Engineering
Walchand College of Engineering, Sangli

Title of the Course: Applied Mathematics for Computer Science and Engineering Course Code: 4CS201	L	T	P	Cr
	3	0	0	3

Pre-Requisite Courses: Engineering Mathematics I and Engineering Mathematics II

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", Prentice Hall PTR, 1995.
 3. Timothy C. Urdan, "Statistics in Plain English", Routledge-Taylor and Fransis Group, 3rd Edition, Volume 1, 2010.

References:

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

Course Objectives :

1. To understand the mathematical theory of Linear Algebra, Probability and Statistics for computer science engineers.
2. To develop skills necessary to solve practical problems in cryptography, data science and machine learning.
3. To understand 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	To illustrate the concept of Linear Algebra and Fuzzy sets with case studies.	2	Understanding
CO2	To apply mathematical and statistical tools for data analysis	3	Applying
CO3	To identify and solve mathematical problems using tools from mathematical areas, including algebra, analysis, statistics and number theory.	3,4	Applying, Analyzing

CO-PO Mapping : (Use 1,2,3 as correlation strengths)

PO	1	2	3	4	5	6	7	8	9	10	11	12	13(PSO1)	14(PSO 2)
CO1	2													
CO2	3				1								3	
CO3		3		2										

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 Vector Spaces Introduction, Vector spaces, Linear combinations, Spanning sets, Subspace, Linear dependence and independence, Basis and dimension, Null space, Column space, Row space, Rank-Nullity theorem.	6 Hrs.
Module 2 Advanced Concepts in Linear Algebra 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.	7 Hrs.
Module 3 Fuzzy Sets Introduction to characteristics functions, First decomposition theorem, Fuzzy relations, examples, Fuzzy equations, Operations on Fuzzy sets.	7 Hrs.
Module 4 Exploratory Data Analysis 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.	6 Hrs.
Module 5 Topics in probability and statistics Sampling Distributions, Central limit theorem, Single and multivariate: Confidence Interval, Correlation, Causation, Covariance, Pearson's correlation coefficient, resampling and permutation.	7 Hrs.
Module 6 Number theory 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.	7 Hrs.

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:** Explain 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 appropriate statistical methods in the analysis of simple datasets.
- Module 6:** Identify how number theory is related to and used in cryptography.

Title of the Course: Applied Mathematics for Computer Science and Engineering Course Code: 4CS201	L	T	P	Cr
	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

References:

1. Seymour Lipschutz and Mark Lipson, "Schaum's outlines of Theory and Problems of Linear Algebra", Tata McGraw Hill, 3rd Edition, 2007.
2. 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:

1. To infuse an understanding of the mathematical theory of Linear Algebra, Probability and Statistics for computer science engineers.
2. To provide a foundation to solve practical problems in cryptography, data science and machine learning.
3. 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 mathematical and statistical tools for data analysis	3	Applying
CO3	Solve mathematical problems using tools from mathematical areas, including algebra, analysis, statistics 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

N.K. Pikle
13/06/19
N.K. Pikle

Ms. Yadav P.P.
13/06/19

Ms. Yadav P.P.

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 Topics in probability and statistics	7 Hrs.
Sampling Distributions, Central limit theorem, Single and multivariate: Confidence Interval, Correlation, Causation, Covariance, Pearson's correlation coefficient, resampling and permutation.	
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.

N.K. P. P.
13/06/19
N.K. P. P.

Ms. Yadav P.P.
13/06/19
Ms. Yadav P.P.

Module 5:

- Make use of appropriate statistical methods in the analysis of simple datasets.

Module 6:

- Identify how number theory is related to and used in cryptography.

N.K.
13/06/19
N.K. PIKLE

Ms. Yadav
13/06/19
Ms. Yadav P.P.

Title of the Course: Environmental Science	L	T	P	Cr
Course Code: 4HS203	2	1	0	3

Pre-Requisite Courses: Nil

Textbooks:

1. Mrinalini Pande, "Disaster Management", Wiley Publications New Delhi, First edition, 2014
2. N.K Uberoi, "Environmental Studies", Excel Books Publications New Delhi, first edition, 2005
3. R.Rajagopalan, "Environmental Studies from crisis to cure" Oxford university press, second edition, 2011

References:

1. William. Cunningham and Barbara Woodworth Saigo, "Environmental Science: A Global Concern", WCB/McGraw Hill publication, 5th Edition, 1999
2. Peter. H. Raven, Linda. R. Berg, George. B. Johnson, "Environment", McGraw Hill publication, 2nd -Edition, 1998
3. Catherine Allan & George H. Stanley (Editors), "Adaptive Environmental Management", Springer Publications. 2009

Course Objectives :

1. Infuse an understanding of the various environmental concepts on scientific basis in the functional area of Engineering and technology.
2. Provide a foundation to critically assess the approaches to pollution control, environmental and resource management, sustainable development, cleaner technologies, Environmental Legislation based on an understanding of the fundamental, environmental dimensions.
3. Inculcate the modern concept of green industry and the impact of excess human population, globalization, and climate change on the environment.

Course Learning Outcomes:

CO	After the completion of the course the student should be able to	Bloom's Cognitive	
		Level	Descriptor
CO1	Describe key concepts of Environmental science and their relationship to engineering.	2	Understanding
CO2	Explain ethical and legal responsibility of an engineer and his role in effective implementation of sustainable activities through EIA and EMS in the corporate sector.	2	Understanding
CO3	Predict impact of contemporary issues (Population Explosion, Climate change, Environmental pollution) on the environment.	2	Understanding

CO-PO Mapping : (Use 1, 2, 3 as Correlation Strengths)

PO	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	2							
CO2							3	2						
CO3							2							

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(M.S. Ali)

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 60-70% weightage for course content (normally last three modules) covered after MSE.	
Course Contents:	
Module 1: Environment, Ecology and Biodiversity	Hrs.
Introduction: Natural and Built Environment, Environmental education: definition, scope, objectives and importance, Components of the Environment: Atmosphere, Hydrosphere, Lithosphere and Biosphere. Ecology : Introduction, Types (terrestrial and aquatic ecosystems) , Structure and function, Trophic levels, Food chains, food webs, Ecological pyramids, Ecological succession, Biogeochemical cycles. Biological Diversity: Introduction, Value of biodiversity: consumptive use, Threats to biodiversity, Conservation of biodiversity.	7
Module 2: Human Population, Energy and Natural Resources	Hrs.
Human Population Growth and Environment: Population Dynamics, Age structures, Energy Scenario: Future projections of Energy Demand, Utilization of various Energy Sources, Conventional Energy Sources and Non- Conventional Energy Sources, Urban problems related to energy. Natural Resources: Food, Water, Forest, Geological, Equitable Use of Resources for Sustainable life style. Case studies.	5
Module 3: Climate Change, Environmental Quality and Pollution Control	Hrs.
Climate change: Global warming, Ozone depletion, Acid Rain. Environmental Impact: Impact of Modern agriculture on the Environment, Impact of Mining on the Environment, Impact of Large dams on the Environment, Environmental pollution: Air, Water, Soil, Noise, Marine, classification of pollutants, their causes, effects and control measures. Case studies.	5
Module 4: Solid, Hazardous Waste and Disaster Management	Hrs.
Solid and Hazardous waste management: Introduction, categories, causes, effects and management of municipal solid waste, Hazardous waste Disaster Management: Introduction, types of disasters, Disaster mitigation. Case studies.	4
Module 5: Social Issues, Environmental Management and Legislation	Hrs.

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<p>Environmental ethics: Introduction, Ethical responsibility, issues and possible solutions. Environmental Management: Introduction to Environmental Impact Assessment, Environmental Management System: ISO 14001 Standard, Environmental Auditing, National and International Environmental protection Agencies pertaining to Environmental Protection. Environmental Legislation: Environmental protection act 1986, Water (prevention and control of pollution) Act 1974, Air (prevention and control of pollution) Act 1981, Wild life Protection Act 1972, and Forest Conservation Act 1980. Municipal Solid Wastes (Management and Handling) Rules, 2000.</p>	4
<p>Module 6: Cleaner technology</p>	Hrs.
<p>Restoration Ecology, Role of Information Technology in Environment science, Green buildings, Green products, Consumerism and Waste Products, Minimization of Hazardous Products, Reuse of Waste, By-products, Rainwater Harvesting, Translocation of trees. Some Success Stories. Case studies</p>	3
<p><u>Module wise Outcomes</u></p> <p>At end of each module students will be able to</p> <p>Module 1:</p> <ul style="list-style-type: none"> • Determine an in-depth understanding of the interdisciplinary relationship of cultural, ethical, and social aspects of local/global environmental issues. Understand how interactions between organisms and their environments drive the dynamics of individuals, populations, communities, and ecosystems. <p>Module 2:</p> <ul style="list-style-type: none"> • Describe the impact of human population on the environment, and the utilization of natural resources for sustainable life style. <p>Module 3:</p> <ul style="list-style-type: none"> • Explain the issues like Climate change, Global warming, Global Warming Potential, Ozone depletion, Ozone depletion Potential, Impact of Modern agriculture on the Environment, Impact of Mining on the Environment, Impact of Large dams on the Environment, Bio magnification, Eutrophication and apply learned information to postulated environmental scenarios to predict potential outcomes. <p>Module 4:</p> <ul style="list-style-type: none"> • Identify and define different disasters and their mitigation in addition to solid and hazardous waste management. <p>Module 5:</p> <ul style="list-style-type: none"> • Sense the legislation governing environmental research and the environment. Integrate facts, concepts, and methods from multiple disciplines and apply to environmental problems. <p>Module 6:</p> <ul style="list-style-type: none"> • Describe strategies, technologies, and methods for assessment and sustainable management of environmental systems and for the remediation or restoration of degraded environments. 	
<p>Tutorial: The tutorials consist of Quiz, Tests, Assignments in addition to a mini project work based on diverse environmental issues and topics.</p>	

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(M.S. A.I.)

Title of the Course: Discrete Mathematics Course Code: 4CS202	L	T	P	Cr
	3	1	0	4

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


Ms. A.V. Teekhadkar

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.



Ms. A.V. Teekhelkat

Module 5:


- Analyse concepts of trees, minimum cost spanning trees using different types of algorithms.

Module 6:

- Solve problems on permutation, combination and probability.

Tutorials: Group work solutions for Problems based on:

1. CNF, DNF, set theory, Venn Diagrams.
2. Equivalence relation, binary relation.
3. POSET and HASSE diagrams.
4. Algebraic structures.
5. Graph, Shortest path in weighted graphs, Hamiltonian and Eulerian Paths and Circuits
6. Real Time Application of graph theory.
7. Warshall's Algorithm, prims and Kruskal's algorithm
8. Finding out optimal solution based on graph theory and trees.
9. Permutation and combination.


Ms. A. V. Teekhadkar

Title of the Course: Data Structures Course Code: 4CS203	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 McGraw 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

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Dr. N. L. GavanKar

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 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 Sorting: Internal and External Sorts, Insertion, Shell, Heap, Quick sort, Merge sort, Radix sort, Two-way merge sort Hashing: Hashing functions, overflow handling with and without chaining, open addressing: linear, quadratic, double, rehashing 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

Nms
Dr. N. L. Gavankar

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.


Dr. N.L. Gavankar

Title of the Course: Data Communication Course Code: 4CS204	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.

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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 :	
<ul style="list-style-type: none"> Describe Data Communication model and various media for communication 	
Module 2 :	
<ul style="list-style-type: none"> Differentiate different encoding techniques. Apply error control techniques. 	
Module 3 :	
<ul style="list-style-type: none"> Differentiate and analyze various multiplexing techniques. 	
Module 4 :	
<ul style="list-style-type: none"> Distinguish between different switching techniques. 	
Module 5 :	
<ul style="list-style-type: none"> Identify and describe congestion control mechanisms and cellular wireless network. 	
Module 6 :	
<ul style="list-style-type: none"> Describe and differentiate various flow control techniques. 	

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Title of the Course: Computer Organization and Architecture	L	T	P	Cr
Course Code : 4CS205	3	0	0	3

Desirable requirements: Basic Electronics Engineering

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 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

(Ms. A.S. Pawar)

(Mr. S. L. Mahadeshwar)

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.


(Mr. S.L. Mahadeshwar)


(Ms. A.S. Pawar)

Title of the Course: Data Structures Laboratory Course Code: 4CS251	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 theory course 4CS203. The assignment list mainly emphasizes 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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	2	-	-	-	-	-	-	-	-	-
CO2	-	-	-	3	2	-	-	-	-	-	-	-	3	-
CO3	-	-	-	3	2	-	-	-	-	-	-	-	3	-

1: Low, 2: Medium, 3: High

Dr. M.L. Gavankar

Assessments :**Teacher Assessment:**

In Semester Evaluation (ISE), and End Semester Examination (ESE) having 50% weights each.

Assessment	Marks
ISE	50
ESE	50


ISE is based on Experimental work/ Performance in laboratory/assignment

ESE: Assessment is based on Performance and oral.

Course Contents:**List of Experiments:**

Assignments based on topics covered in course 4CS203

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


Dr. N. L. Gavankar

Title of the Course: Computer Organization And Architecture Laboratory	L	T	P	Cr
Course Code: 4CS252	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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2				3									
CO2			3	2	2									

1: Low, 2: Medium, 3: High

A. Pawar
(Mrs. A.S. Pawar)

S. L. Mahadekar
(Mr. S.L. Mahadekar)

Assessments :**Teacher Assessment:**

In Semester Evaluation (ISE), and End Semester Examination (ESE) having 50% weights each.

Assessment	Marks
ISE	50
ESE	50

ISE is based on Experimental work/ Performance in laboratory/assignment/declared test/etc.

ESE: Assessment is based on Performance and oral.

ISE is based on Experimental work/ Performance in laboratory/assignment/declared test/etc.

Course Contents:


Assignments based on topics covered in course 4CS252

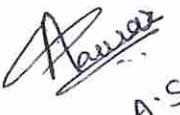
Write assembly language programs

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. 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.

Module wise Measurable Students Learning Outcomes :

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


(Mr. S. L. Mahadeshwar)


(Ms. A. S. Pawar)

Title of the Course: Programming Laboratory 1	L	T	P	Cr
Course Code: 4CS253	0	0	4	2

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 : (Use 1,2,3 as correlation strengths)

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

1:Low, 2:Medium, 3:High

Assessments :

Teacher Assessment:

In Semester Evaluation (ISE), and End Semester Examination (ESE) having 50% weights each.

Assessment	Marks
ISE	50
ESE	50

ISE 1 and ISE 2 are based on Quiz and demonstration of programs.

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.


A.v. Jekhedkar

Ms A.v. Jekhedkar

B.F. Masani

Course Contents:	
Module 1: Introduction to object oriented programming	8 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. Experiments: 1. Program based on creating Class and Object. 2. Program based on constructor and destructor.	
Module 2: Properties of object oriented programming	9 Hrs.
Inheritance and its types, pointers, virtual functions, Polymorphism, container class. File and Streams: Streams, String I/O, Character I/O, Object I/O, Exception Handling, Templates, Namespace fundamentals, Overview of Stream classes. Experiments: 1. Implementation of Inheritance and polymorphism. 2. Working with files and stream classes. 3. Use of template, generic template and function. 4. Creation of namespaces.	
Module 3: Introduction and getting started with python programming	9 Hrs.
Running Code in the Interactive Shell, Input, Processing, and Output, Editing, Saving, and Running a Script, Behind the Scenes: How Python Works. Data Types and expressions: Numeric Data Types and Character Sets, Integer, Floating-Point Numbers, Character Sets, Arithmetic Expressions, Functions and Modules. Experiments: 1. Introduction and getting started with python programming: running code in the interactive shell 2. Program based on expression, data type, functions	
Module 4: Features of python programming	9 Hrs.
Loops and selection statements, String and Text files, Lists and dictionaries: List Literals and Basic Operators, List Methods for Inserting and Removing Elements, Dictionary Literals. Experiments: Programs based on implementation of loops, strings, lists and dictionaries.	
Module 5: Design with Classes	8 Hrs.
Getting Inside Objects and Classes, A First Example: The Student Class, Graphical User Interfaces, Coding Simple GUI-Based Programs, Windows GUI components. Experiments: Programs based on Graphical user interface design using python.	
Module 6: Network Programming, file handling and data structure using python	9 Hrs.
Multi-threading, Networks, and Client/Server Programming, Searching, Sorting, Exception handling, string processing, file handling, stack, Queues, heaps. Experiments: 1. Programs related to Multi-threading, file handling. 2. Programs related to concepts like stack, Queues, heaps.	


Dr. B. F. Momin


Ms. A. V. Teekhedkar

Title of the Course: Development of Societies Course Code: 4HS201	L	T	P	Cr
	2	0	0	2

Pre-Requisite Courses: Nil

Textbooks:

1. Bakshi. P. M, "The Constitution of India" Universal Law Publishing Co., Delhi, 2009
2. Sankhdher, M.M. "The Welfare State", Deep and Deep publications, Delhi, 2003
3. Ved Prakash. K. Biswal, "Perspectives on Education and Development", Shipra Publication, 2008

References:

1. James Midgley, "Social Development: Theory and Practice", Sage publication, 2005
2. David Piachaud and James Midgley, "Social Protection, Economic growth and Social change", Edward Elgar publications, 2013
3. Szymon Chodak, "Societal Development: Five Approaches with Conclusions from Comparative Analysis", Oxford University Press, 1974

Course Objectives :

1. Introduce students to the field of social development with a strong emphasis on families and communities using the Development Goals and Human Rights frameworks.
2. Provide students with an understanding of the key concepts and issues related to societal development such as poverty, inequality, and exclusion.
3. Encourage students to explore alternative paths of societal development that promotes the well-being of individuals, families, and communities in India or around the world.

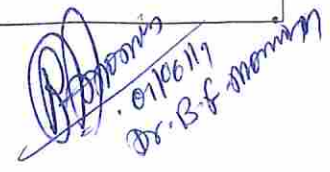
Course Learning Outcomes:

CO	After the completion of the course the student should be able to	Bloom's Cognitive	
		Level	Descriptor
CO1	Explain "Societal development" and the role of India's Development Goals in shaping social development in the globalized world.	2	Understanding
CO2	Examine critically the role of human rights in constraining or advancing development of societies.	2	Understanding
CO3	Describe the key social development issues confronting individuals, families, and communities in contemporary societies and explore the role of social advertisement and education in promoting Societal development in India.	2	Understanding

CO-PO Mapping :

PO	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	2							
CO2						2	2							
CO3						2	2							


 (M.S. Ali)


 Dr. B. B. Momin

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 60-70% weightage for course content (normally last three modules) covered after MSE.	
Course Contents:	
Module 1: CONCEPT AND DEFINITIONS OF DEVELOPMENT.	Hrs.
Meaning and Concept of development, development in India in Pre British, British and Post British period, Idea of development in current context, Characteristics of Development, Perspectives on Development, Dimensions of Development, Models of Development.	4
Module 2: SOCIAL DEVELOPMENT	Hrs.
Social development: Meaning and definitions, Relationship between human being and society, Concept behind the origin of Family, Clan and Society, Children's rights, education and social development, Women's rights, gender equality and social development, Features of Social Development, Social Development in the United Nation's Agenda, Social Development in India, Factors facilitating Social Development, Factors hindering Social Development, Comparative study on different models of social structures and their evolution.	5
Module 3: ECONOMIC DEVELOPMENT	Hrs.
Meaning and concept, Capitalism, Socialism, Marxism. Barter, Jajmani. Materials economy: The story of stuff project. Characteristics of economic development, Why countries desire economic development? Key drivers of economic development, Circle of Economic Development, Phases of economic development, Barriers to economic development, Buddhist Economics, Gandhian idea of Development, Swarajya and decentralization.	7
Module 4: POLITICAL DEVELOPMENT	Hrs.
Concept, History and ideas of political system Different models of governing systems and their comparative study.	3
Module 5: HUMAN DEVELOPMENT	Hrs.
The Concept of Human Development, Human Development in the United Nation's Agenda, Human development Approach vs. the Conventional Development Approach, Indicators of human development, Economic development and human development, Barriers to human development:	5
Module 6: SUSTAINABLE DEVELOPMENT	Hrs.

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<p>Meaning and definition, Origin of the concept, World Conventions on Sustainable Development, Objectives of sustainable Development, Requirements of sustainable Development, Dimensions of Sustainable Development, Key Issues in Sustainable Development, Challenges to Sustainable Development</p>	<p>6</p>
<p>Module wise Outcomes</p> <p>At end of each module students will be able to</p> <p>Module 1:</p> <ul style="list-style-type: none"> • Conceptualize what is development, its characteristics, its dimensions, perspectives and models. <p>Module 2:</p> <ul style="list-style-type: none"> • Comprehend the meaning and features of social development and the UN's commitment for social development. Added to that you can note the process of social development in India along with the factors facilitating and hindering social development. <p>Module 3:</p> <ul style="list-style-type: none"> • Understand the meaning of economic development and growth along with its characteristics, need of economic growth, phases of economic growth, driving forces that promote economic growth, its difference from economic development and barriers to the process. <p>Module 4:</p> <ul style="list-style-type: none"> • Understand the meaning of political development, ideas of political system and different models of governing systems. <p>Module 5:</p> <ul style="list-style-type: none"> • Develop an idea of the concept of human development, the reflection of the concept of human development in the UN agenda, how the concept departs from the conventional development models, indicators of human development and barriers to human development. <p>Module 6:</p> <ul style="list-style-type: none"> • Trace out the meaning, origin, requirements of sustainable development, its pre-requisites. The unit will also impress upon the students about the world conventions on sustainable development, its dimensions, issues arising and challenges faced by the process. 	


 (M.S. Ali)

Title of the Course: Software Engineering	L	T	P	Cr
Course Code: 4CS221	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

A.R. Sanyal

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	PSO 1	PSO 2
CO1			3								3	2	3	
CO2			1	2				3	3	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	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	

A.R. Surve

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.

A.R. Sume

Title of the Course: Formal Language and Automata Theory Course code: 4CS222	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	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	3	-	2	-	-	-	-	-	-	-	-	3	-
CO3	3	3	-	2	-	-	-	-	-	-	-	-	3	-

1: Low, 2: Medium, 3: High

Dr. N. L. Gavankar

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 \wedge transitions, Equivalence of DFAs, NFAs and NFA- \wedge 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 \wedge 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.

Dr. N.L. Gawankar

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.



Dr. N.L. Gavankar

Title of the Course: Operating Systems	L	T	P	Cr
Course Code: 4CS223	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. Dhamdhare, "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.Dhamdhare, "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	PO11	PO12	PSO1	PSO2
CO1	2													
CO2	3	2											2	
CO3	2	3											3	

1: Low, 2: Medium, 3: High


 (Mr. S. L. Mahadeshwar)

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 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 : Process concept, process scheduling, operation on process, inter-process communication, example of IPC systems and communication in client-server systems. Process Scheduling: Basic concepts, scheduling criteria, scheduling algorithm, algorithm evaluation.	
Module 4 : Process Coordination	7Hrs.
Synchronization : Background, the critical section problem, Peterson's solution, synchronization hardware, semaphores, classic problems of Synchronization. Deadlock : System model, deadlock characterization, methods for handling deadlocks, deadlock prevention, deadlock avoidance, deadlock detection.	
Module 5 : Memory Management	8Hrs.
Memory-Management Strategies : Background, swapping, contiguous memory allocation, paging, structure of the page table, Segmentation. Virtual Memory Management : Background, demand paging, copy-on-write, page replacement algorithms, allocation of frames, Thrashing.	
Module 6 : Storage Management	5Hrs.
File System : File concept, access methods, directory and disk structure, file-system mounting, file sharing, protection.	


(Mr. S. L. Mahadeshwar)

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.



(Mr. S.L. Mahadikar)

Title of the Course: Database Engineering Course Code: 4CS224	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


KPK

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. 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, 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. 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 Course Code: 4CS225	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

Handwritten signature and date:
21/6/19 pjm

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.

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Title of the Course: Database Engineering Laboratory Course Code: 4CS271	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 :**Teacher Assessment:**

In Semester Evaluation (ISE), and End Semester Examination (ESE) having 50% weightage each.

Assessment	Marks
ISE	50
ESE	50

ISE is based on performance of students 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: Assessment is based on performance and oral.

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++

Module wise Measurable Students Learning Outcomes :

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

Title of the Course: Computer Network Laboratory Course code: 4CS272	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 :

Teacher Assessment:

In Semester Evaluation (ISE), and End Semester Examination (ESE) having 50% weights each.

Assessment	Marks
ISE	50
ESE	50

ISE is based on Experimental work/ Performance in laboratory/assignment/declared test/etc.

ESE: Assessment is based on Performance and oral.

ISE is based on Experimental work/ Performance in laboratory/assignment/declared test/etc.

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PDM

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

Module wise Measurable Students Learning Outcomes :

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

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Title of the Course and Course code: Programming Laboratory 2 Course Code: 4CS273	L	T	P	Cr
	0	0	4	2

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

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<ol style="list-style-type: none"> 5. Static block, initialization block and constructor block – execution order 6. Implementation of different types inheritance, Multiple Inheritance using Interface 7. Implementation of Inheritance <ul style="list-style-type: none"> • Method overriding • super constructor and super keyword • abstract class • not allow class or method or both to extend/inheriting to another class 8. Implementation of Package and access mechanism in package <ul style="list-style-type: none"> • Exception handling in package 9. String class implementation, basic operation, creating immutable and mutable string 10. Exception Handling for – Checked Exception <ul style="list-style-type: none"> • Divide by zero error • Null values • Data entry • Checked exception classes • Exception handling – checked exception, order of exception handling, throwing exception • Creating user defined exception 	
Module 2 - JAVA IO AND UTIL PACKAGE	14 Hrs.
<p>I/O programming – Hierarchy of classes in I/O Package Streams Classes: Character oriented and Byte oriented, reading and writing Reading and Writing basic data types from keyboard File handling in Java. Collection Classes: java.util package Utility Methods for Arrays – Array Class The Collection Framework : Collections Hierarchy, List, Set, Queue, Map Date & Times class – get time and date, set date and time</p> <p>Experiments:</p> <ol style="list-style-type: none"> 1. Program to read basic data types from keyboard using Scanner and check the entered values' data type for its appropriateness. <ul style="list-style-type: none"> • Different classes of IO and reading values from keyboard • Exception in IO 2. Program to read the data from user and save it to two different files, display the contents and exchange the contents of those two files using IO package – byte by byte. 3. Program to read the data from user and save it to two different files, display the contents and exchange the contents of those two files using IO package – char by char. 4. Program to read the data from user and save it to two different files, display the contents and exchange the contents of those two files using IO package – Object by Object. 5. Implement Arrays Class and perform array operation. 6. Implement collection utility classes – list, set, queue, map with their specific methods available in interface or implemented class. 7. Implement exception related to IO and collection classes. 	

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CO-PO Mapping :														
PO and PS O	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 :

Teacher Assessment:

In Semester Evaluation (ISE), and End Semester Examination (ESE) having 50% weights each.

Assessment	Marks
ISE	50
ESE	50

ISE is based on experimental work/ performance in laboratory/assignment etc.

ESE: Assessment is based on performance and oral.

Course Contents:

Module 1 - FUNDAMENTALS OF JAVA

14 Hrs.

An Introduction to Java - Features of JAVA language, Java Programming Environment – JDK, JRE, JVM, Fundamental Programming Structures in Java, Comparison of Java with C++
 Class and Object, use of keywords like final, static, abstract, interface, etc
 Wrapper Classes, value conversion primitive to object and object to primitive, toString use
 Inner Classes - Static and Non-Static inner classes
 Inheritance, Interface, Polymorphism, Overriding
 Packages and Access Control Mechanism
 String Class – operation on string, string-pool, equals and == difference on string, immutable and mutable string class, StringBuilder/StringBuffer class
 Exceptions Handling – Checked Exception and UncheckedException, User Defined Exception
 Creation and use
 Debugging the JAVA code

Experiments:

1. Installation of jdk package, understand the difference between jdk and jre folder, set environment variable PATH/CLASSPATH.
2. Describe JDK, JRE and JVM. Differentiate between C, C++ and JAVA.
3. 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.
4. Class and Method Implementation by –
 - Method Overloading
 - Constructor Overloading
 - Static - data members and methods
 - Inner classes
 - Simple Exception handling – checked exception, order of exception handling, throwing exception
 - Debugging of java program

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<p>Module 3 - MULTITHREDDING IN JAVA</p> <p>Multithreading – Classes support thread creation and execution Thread States & Synchronization of threads Deadlock handling</p> <p>Experiments:</p> <ol style="list-style-type: none"> 1. Multithreading – display thread information. 2. Multithreading – create thread using Thread and Runnable class. 3. Multithreading – thread communication and synchronization of threads. 4. Implement exception related to multithreading. 	<p>8 Hrs.</p>
<p>Module 4 – JAVA-ORACLE DATABASE CONNECTIVITY</p> <p>Introduction to JDBC (Oracle Connectivity) JDBC Drivers & Initialization Creating Connection and Connecting to Databases CURD operation Using JDBC (Oracle Connectivity) Performing operations on specific row in oracle database using JDBC</p> <p>Experiments:</p> <ol style="list-style-type: none"> 1. Design Database program for Employee details and implement INSERT, SELECT, DELETE, and UPDATE queries. 2. Implement ResultSet class. 3. Implement RowSet class. 4. Implement exception related to java database connectivity. 	<p>6 Hrs.</p>
<p>Module 5 - NETWORK PROGRAMMING WITH JAVA</p> <p>Network programming with java - Hierarchy of classes in NET package Client Server Programming Concurrent and Iterative server design Introduction of Distributed - Programming in Java RMI Application Designing RMI client & server</p> <p>Experiments:</p> <ol style="list-style-type: none"> 1. Implementation of Client / Server mechanism using Socket classes. 2. Design concurrent server that will handle multiple clients using multithreading. 3. Develop a simple client-server application using RMI. 4. Implement exception related to socket and RMI. 	<p>6 Hrs.</p>
<p>Module 6 - GRAPHICAL USER INTERFACE IN JAVA</p> <p>GUI Design in Java – User Interface Event Handling in Java - Event delegation model (MVC model) Classes supporting event handling Components with swings, Applets, Graphics Programming, Swing Components Tree, Table etc.</p> <p>Experiments:</p> <ol style="list-style-type: none"> 1. GUI design and Event handling 2. Develop an animation program using Multithreading viz. Bouncing Ball. 3. Program to scroll the banner using applet. 4. Program using Applet to illustrate event handling with interactive radio buttons to control font style of a text field. Also provide a text box where in the user may enter font size. 5. Design 8-digit calculator using AWT package and layout managers. 6. GUI design using Swing package - a) Celsius to Fahrenheit conversion b) Login and Password Verification. 7. Implement exception related to event handling, GUI design, applets. 	<p>8 Hrs.</p>

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Walchand College of Engineering, Sangli

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Credit System and Course Content

Third Year B.Tech.

Computer Science and Engineering

Semester V and VI

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: 18th Jan 2020

The BoS meeting was held on 18/01/2020 at 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. Hetal Gandhi, Mr. V. N. Honmane, Mr. S. L. Mahadeshwar, Mr. K. P. Kamble, Mr. S. S. Sontakke, Mrs. N. L. Mudegol, Ms. A. V. Terkhedkar, Miss. A. S. Pawar, Miss. P. D. Mundada, Mr. S. D. Pujari, Mrs. S. S. Rokade, Mrs. A. T. Umarani, Miss. A. A. Kale.

From outside of WCE: Dr. G. A. Patil (D Y Patil, COE, Kolhapur) and Dr. Prasad Gokhale (Vishwakarma University, Pune).

Invitee member: 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 TY B.Tech CSE syllabus revamping AICTE guidelines have been followed. 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	Jan
• 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	✓

22/01/2020

Activities	Jan
<ul style="list-style-type: none"> • Formation of ICC. Functions: <ul style="list-style-type: none"> ○ 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 	
<ul style="list-style-type: none"> ○ Final year projects with sponsorships ○ Collaborative research/consultancy for students and faculties ○ Providing technical inputs to start-ups. 	
<ul style="list-style-type: none"> • Examining the existing curriculum for its suitability of industry demand. 	√

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

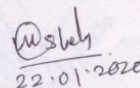
1. Earlier BoS Minutes of Meeting was confirmed.
2. Regarding finalization of Third Year Syllabus structure and syllabus contents following points are discussed:
 - a. The number of COs can vary from 1 to 6 considering 1 CO for each module.
 - b. **Compiler Design:**
 - a. For Compiler Design course tutorial can be taken with the help of different Code Optimization Tools, Open Source Tools, LEX, etc.
 - b. Add reference book: Refer IIT Kanpur syllabus.
 - c. **Design and Analysis of Algorithm:**
 - a. Remove "Parallel Algorithm" point from Module 6.
 - b. Shift "Graph Traversal Techniques" from Module 5 to Module 6.
 - d. **Design and Analysis of Algorithm Lab:**
 - a. Add "Shaum's Series" book as a reference book.
 - b. Students may use C, C++ using STL, Java for implementation.
 - c. Each batch can be assigned different assignments on each topic (can be followed for all laboratory courses).
 - d. Creative assignments/Open ended/Real time problems can be given as assignments.
 - e. **Computer Graphics Lab:**
 - a. Add book by author "Philips".
 - b. OpenGL and other animation tools can be used.
 - c. Remove entire "Image Processing" point from Module 6.
 - f. **Mini Project-I:**
 - a. Remove domain names from the structure.
 - b. Problem statements should be fixed by first or second week of start of the semester.
 - c. A seminar on Idea Presentation can be conducted as soon as the idea is fixed.

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- d. Students should incorporate Agile Methodology for Mini Project-I and same should reflect in syllabus.
- g. Programming Lab-III:**
- NoSQL databases can be considered to be excluded from the syllabus.
 - Syllabus can be further improvised with the help Industry Specialist.
- h. Machine Learning:**
- Syllabus content is fine.
- i. Image Processing:**
- Change the name of Module 5. Suggested name is “Morphological Operations”.
 - Test cases/applications can be added to module 1.
- j. Internet (Web) of Things:**
- Swap Module 3 and Module 4.
 - Thought can be given on improvising the contents of Module 5.
 - IBM website can be referred for formation of courses related to IoT.
- k. Distributed System and Cloud Computing:**
- Change course name to “Cloud Computing”.
 - Module 1 and Module 2 should be based on Distributed Computing.
 - Module 6 can be based on Cloud Security.
- l. Advanced Database System:**
- Split Module 5 into two modules.
- m. Advanced Database System Laboratory:**
- Mini projects can be given as an assignments.
- n. Mini Project 2:**
- Same suggestions as for Mini Project-I.
- o. Advanced Web Programming Laboratory:**
- Two separate courses can be offered as follows:
 - Advanced Web Programming Laboratory**
 - Mobile Application Development Laboratory**
 - Change Module 5 contents of existing syllabus for “Advanced Web Programming Laboratory”.
- p. Software Tools Laboratory:**
- Change course name to “Software Engineering Tools”.
 - Syllabus can be further improvised with the help Industry Specialist.
- q. Soft Computing:**
- Combine Module 1 and Module 2.
 - Increase the content of Unsupervised Learning.
- r. Computer Vision:**
- Syllabus contents to be reviewed.
 - Remove Overlapping with Image Processing.
- s. Advanced Computer Network:**
- Following contents to be added: Mobile and Wireless Communication, High Performance Networking.




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- t. **Remote Sensing and Geographic Information System:**
 - a. Syllabus is fine.
 - u. **Deep learning:**
 - a. Syllabus is Fine.
3. Open Electives to be offered at TY-I and TY-II semester:
 - a. **Software Engineering and Database Essentials:**
 - a. Syllabus content is fine.
 - b. **Algorithms and Applications:**
 - a. Remove course.
 - b. Replace with new course named **"Data Science using Python"**.
 - c. **Data Analytics:** To be removed
 - d. **Network Essentials:** Remove and add course named **"Cyber Security"**.
 - e. New course named **"AI and Machine Learning"** added and its syllabus contents were discussed.
4. Approval of syllabus of Minor degree in CSE
 - a. Syllabus of courses Software Engineering and Database Engineering were discussed.
 - b. For Database Engineering Swayam course can be offered as a part of syllabus.
5. B.Tech (Honors) and specialization
 - a. B.Tech (Honors) and specialization can be offered in the following areas:
 - I. Data Science
 - II. Cloud Computing
 - III. Computer Security
 - IV. Human Computer Interaction (HCI)
6. Revision of PSOs
 - a. Current PSOs were discussed and possible changes to be considered.
 - b. Statements of PSOs can be based on Professional Electives and Open Electives (Stream specific).
7. Industry participation and project evaluation
 - a. It is highly recommended and actions to do so were discussed.
 - b. Industry participation can be incorporated via existing Alumni network.
8. It is suggested that there should be conduction of workshops based on current software engineering practices for faculty conducted by industry experts.
9. Center of Excellence (COE) can be formed on following streams:
 - a. Data Science and Engineering
 - b. Internet of Things (IoT)
 - c. Computer Network and Security
10. The meeting was ended with vote of thanks.



The Chairman, BoS (CSE)
Date: 18th Jan 2020

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22.01.2020



**WALCHAND COLLEGE OF ENGINEERING,
SANGLI**

**Department of Computer Science and Engineering
Board of Studies Minutes of Meeting**

Date of BoS: 20th Jun 2020

The BoS meeting was held online on 20/06/2020 at 11:00 AM on Google meet platform. Following members were present:

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

From outside of WCE: Dr. G. A. Patil (D Y Patil, COE, Kolhapur) and Dr. Prasad Gokhale (Vishwakarma University, Pune), Dr. Vrushali Kulkarni (MIT, Pune), Mr. Suhas Desai (Industry expert), Mr. Pankaj Koti (Industry expert).

With 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 TY B.Tech CSE syllabus revamping AICTE guidelines have been followed. 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	Jan	Feb	Mar	Apr	May	Jun
• 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	✓					✓

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Activities	Jan	Feb	Mar	Apr	May	Jun
<ul style="list-style-type: none"> • Formation of ICC. Functions: <ul style="list-style-type: none"> ○ 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. 				√	√	√
<ul style="list-style-type: none"> • 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 finalization of Third Year Syllabus structure and syllabus contents following points are discussed:
 - a. **Course outcomes and CO-PO mapping:**
 - a. It is suggested to have 3 to 6 COs as per requirement or 5 CO each linking to one module with one generic CO for all 6 modules.
 - b. Verbs of course learning outcomes need to be revised: removal of verbs like Discuss, Explain, and Describe etc.
 - c. Suggested to have brainstorming session on CO-PO mappings of courses.
 - b. **Compiler Design:**
 - a. Parallel compilation, JIT, advanced concepts can be included.
 - c. **Design and Analysis of Algorithm:**
 - a. A new module on hybrid techniques can be introduced.
 - d. **Design and Analysis of Algorithm Lab:**
 - a. No change.
 - e. **Computer Graphics Lab:**
 - a. No change.
 - f. **Mini Project-I:**
 - a. No change.
 - g. **Programming Lab-III:**
 - a. JSON can be introduced instead of XML.
 - b. JQuery can be considered to be removed.
 - h. **Machine Learning:**
 - a. Syllabus content is fine.

Mushah
22.07.2020

- i. Image Processing:**
 - a. Title of course finalized as “Digital Image Processing”.
 - j. Internet (Web) of Things:**
 - a. IOT devices can be introduced in separate module to justify web in the course name.
 - b. Third module can be “Devices and Architecture”.
 - k. Distributed System and Cloud Computing:**
 - a. Change course name to “Cloud Computing”.
 - b. Recent text books should be mentioned.
 - c. Hands on should be taken on case studies in ISE with respect to last module to justify the intention of last module.
 - l. Advanced Database System:**
 - a. Big data, Cloud Native, Data Lake can be considered to be covered in syllabus.
 - m. Advanced Database System Laboratory:**
 - a. No change.
 - n. Mini Project 2:**
 - a. Thought on considering mentioning the point of commercialization in the syllabus.
 - o. Advanced Web Programming Laboratory:**
 - a. Instead of Android, adding IOS can be considered.
 - p. Software Engineering Tools Laboratory:**
 - a. JERA, SOAD can be added. It is suggested to remove CVS and SVN.
 - q. Soft Computing:**
 - a. No change.
 - r. Computer Vision:**
 - a. No change.
 - s. Advanced Computer Network:**
 - a. 4G and 5G can be added.
 - t. Remote Sensing and Geographic Information System:**
 - a. Suggested to focus on applications.
 - u. Deep learning:**
 - a. Adding of Hands-on session suggested.
 - b. Can be considered to be offered as Professional electives laboratory 1 instead of Professional Elective 2.
3. Open Electives to be offered at TY-I and TY-II semester:
- a. Software Engineering and Database Essentials:** No change
 - b. Data Science using Python:** No change
 - c. AI and Machine Learning:** No change
 - d. Cyber Security:** Phishing can be added.

Subh
22.07.2020

4. Approval and discussion on structure and syllabus of B.Tech Honors and specialization degree in CSE

a. B.Tech honors in Cyber Security:

a. The following courses can be considered in the structure:

- i. Network Infrastructure.
- ii. IDS/IPS
- iii. Application security
- iv. Penetration testing.
- v. Mobile security
- vi. Secure software and malware analysis.

b. Syllabus can be refined by referring PARDU University and NIT syllabus.

b. B.Tech honors in Data Science:

- a. Cross checking for python syllabus overlapping.
- b. It can be made self-learning using spoken tutorials of IITB, NPTEL and SWAYAM MOOCs etc.
- c. It should be proctored.
- d. If self-learning is opted syllabus needs to be finalized as all online MOOCs have different syllabus.
- e. R Programming can be added.

5. It is discussed that almost all trending technologies are covered and the syllabus is in-line with industry practices.

6. It is discussed whether the syllabus is in-line with other universities in India and other countries. It is suggested that for theory courses we have 4 modules focused on theoretical concepts and 2 modules can be focused on Applications, practical, hands on etc.

7. The meeting was ended with vote of thanks.

Post BoS Resolutions are as follows:

1. Program specific Outcomes modified as follows:

The students after successfully completing Computer Science and Engineering program will have,

PSO1: Domain-Specific Knowledge: An ability to apply techniques to develop computer-based solutions using domain-specific knowledge of Data Science, Computer vision, Security, Database, IoT, and allied.

PSO2: Software System Design: An ability to adapt to evolutionary changes in computing and apply standard practices and strategies of software project development and management to provide efficient solutions to real-life problems.

W.S. Jadhav
22.07.2020

2. Tentative honors structure finalized as follows:

B.Tech. (HONS) with specialization in Data Science

Semester	Course Name	Options	Credit
V	Introduction to Data science and Data Visualization	Mandatory	4
VI	Data Cleaning and SQL for Data Science	Mandatory	4
VII	Elective1	Natural Language Processing Data Science in Stratified Healthcare and Precision	4
VIII	Elective2	Spatial Data Science and Applications Data Analysis for Social Scientists	4
VIII	Mini Project (semester VIII)	Mandatory	2

B.Tech. (HONS) with specialization in Cyber Security

Semester	Course Name	Options	Credit
V	Cyber Security Fundamentals	Mandatory	4
VI	Digital Forensics	Mandatory	4
VII	Elective1	Ethical Hacking Cloud Security	4
VIII	Elective2	IoT Security Security and Privacy for Big Data	4
VIII	Mini Project (semester VIII)	Mandatory	2

3. Value added Professional courses to be floated finalized are:

Course Name	Credits
Introduction to Unmanned Aerial Vehicles (Drones)	1
Introduction to Game Design and Development using Unity 3D	2

Mishra
22.07.2020

4. Following changes are reflected in PG structure:

- a) To enhance engagement of industry in developing innovations and problem solutions the course named "Pre-dissertation work and seminar" renamed to "Mini-Project with Seminar" with revised structure. The number of credits is updated from 2 to 4 with 2 additional credits and so scheme will be (0-0-8). Here mini projects will promote hands-on experience for students and will be based on problems given by domain experts.
- b) The Laboratory for core courses in Semester-I and Semester-II are merged into a single Laboratory course- "Laboratory-I" and "Laboratory-III" respectively with 2 credits and scheme (0-0-4) for each.
- c) The Laboratory for Professional Elective courses in Semester-I and Semester-II are merged into a single Laboratory course- "Laboratory-II" and "Laboratory-IV" respectively with 1 credit and scheme (0-0-2) for each.
- d) It is proposed that one of the elective course /core course at each semester will be offered through MOOC platform.

Mishra
22.07.2020

The Chairman, BoS (CSE)
Date: 20th Jun 2020

**Department of Computer Science & Engineering
Walchand College of Engineering, Sangli.**

1. Program specific Outcomes modified as follows:

Credits	Course Name
1	Introduction to Unmanned Aerial Vehicles (UAVs)
1	Introduction to Game Design and Development using Unity 3D

Mishra
22.07.2020

Credit System and Evaluation Scheme

Walchand College of Engineering, Sangli
(An Autonomous Institute)
Teaching and Evaluation Scheme effective from 2020-21
Third 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	PC	4CS301	Compiler Design	3	1	0	4	4	10	30	10	50
2	PC	4CS302	Design and Analysis of Algorithms	3	0	0	3	3	10	30	10	50
3	PC	4CS303	Computer Graphics	2	0	0	2	2	10	30	10	50
Professional Core (Lab)												
4	PC	4CS352	Design and Analysis of Algorithms Lab	0	0	2	2	1	25	25	25	25
5	PC	4CS353	Computer Graphics Lab	0	0	2	2	1	25	25	25	25
6	PC	4CS341	Mini Project 1	0	0	2	2	1	25	25	25	25
7	PC	4CS354	Programming Lab 3	0	0	4	4	2	25	25	25	25
Mandatory Life Skill Courses												
8	HS	4HS307/401	Fundamentals of Management and Economics for Engineers	4	0	0	4	4	10	30	10	50
Professional Elective												
9	PE	4CS3**	Professional Elective 1	3	0	0	3	3	10	30	10	50
Open Elective												
10	OE	4OE3**	Open Elective 1	3	0	0	3	3	10	30	10	50
Value Added Professional Courses												
11	VAPC	Refer list	Value Added Professional Courses				2	# 2				
Value Added Life-Skill Courses												
12	VALS	Refer list	Value Added Life Skill Courses				2	# 2				
Total				18	1	10	29	24				

Course List for T.Y. B.Tech. CSE Sem I AY 2020-21

Sr.No.	Course Code	Course Name
Professional Elective 1		
1	4CS311	Machine Learning
2	4CS312	Digital Image Processing
3	4CS313	Internet (Web) of Things

Walchand College of Engineering, Sangli
(An Autonomous Institute)
Teaching and Evaluation Scheme effective from 2020-21
Third 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	PC	4CS321	Cloud Computing	3	0	0	3	3	10	30	10	50
2	PC	4CS322	Advanced Database System	3	0	0	3	3	10	30	10	50
Professional Core (Lab)												
3	PC	4CS372	Advanced Database System Lab	0	0	2	2	1	25	25	25	25
4	PC	4CS342	Mini Project 2	0	0	2	2	1	25	25	25	25
Mandatory Life Skill Courses												
5	HS	4HS3**	Elective Foundation Course in Humanities	3	0	0	3	3	10	30	10	50
Professional Elective												
6	PE	4CS3**	Professional Elective 2	3	0	0	3	3	10	30	10	50
Professional Elective Laboratory												
7	PEL	4CS3**	Professional Electives 1 Lab	0	0	4	4	2	25	25	25	25
Open Elective												
8	OE	4OE3**	Open Elective 2	3	0	0	3	3	10	30	10	50
Value Added Professional Courses												
9	VAPC	Refer list	Value Added Professional Courses				2	# 2				
Value Added Life-Skill Courses												
10	VALS	Refer list	Value Added Life Skill Courses				2	# 2				
Total				15	0	8	23	19				

Course List for T.Y. B.Tech. CSE Sem II AY 2020-21

Professional Elective 2		
1	4CS331	Soft Computing
2	4CS332	Computer Vision
3	4CS333	Advanced Computer Network
4	4CS334	Remote Sensing and Geographic Information System
5	4CS335	Deep Learning

Professional Electives 1 Laboratory		
1	4CS381	Advanced Web and Mobile Application Development Laboratory
2	4CS382	Software Engineering tools Laboratory



Walchand College of Engineering, Sangli
(An Autonomous Institute)

Curriculum Structure for Minor in Computer Science and Engineering

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

VIII <i>(one course from three options should be opted for semester VIII)</i>	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: Compiler Design Course code: 4CS301	L	T	P	Cr
	3	1	0	4

Desirable requirements: Formal Language and Automata Theory, Discrete Mathematics.

Textbooks:

1. D.M. Dhamdhare, “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. Shethi and J.D. Ullman, “Compilers - Principles, Techniques and Tools”, Addison Wesley Publishing Company, 2007.

Course Objectives: This course will provide the in-depth knowledge of different concepts involved while designing a compiler.

- To introduce fundamentals of compiler design and various tools used to design a compiler
- To inculcate role of various phases involved during design of a compiler and impart in depth working of each phase.
- To exercise design of various phases of a compiler using compiler design tools and techniques.

Course Learning Outcomes:

CO	After the completion of the course the student should be able to	Bloom’s Cognitive	
		level	Descriptor
CO1	Discuss the need of compiler, fundamental concepts and various tools used to design a compiler.	2	Understanding
CO2	Demonstrate role and working of each phase involved during compilation.	3	Applying
CO3	Analyze the working of various phases of compiler.	4	Analyzing
CO4	Assess various phases of compiler using compiler design tools and techniques.	5	Evaluating

CO-PO Mapping :

PO and PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2												2	
CO2	3												3	
CO3		3												
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 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: Fundamentals of Compiler Overview- Structure of a compiler, applications of compiler, one pass and two pass compiler. Lexical analysis - The role of a lexical analyzer, specification of tokens, recognition of tokens, LEX.	6 Hrs.
Module 2 Syntax Analysis 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 Hrs.
Module 3 Syntax Directed Translation & Run time environments 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 Hrs.
Module 4 Intermediate Code Generation 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 Hrs.
Module 5 Code Optimization 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 Hrs.
Module 6 Code Generation 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 <i>getReg</i> , DAG, peephole optimization, register allocation and assignment, selection of instruction, register allocation, parallel compilation, Just-in-Time compiler, study of compiler construction tools.	7 Hrs.

Module wise Measurable Students Learning Outcomes :

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

Module 1: Fundamentals of Compiler

1. Discuss fundamental concepts of compiler design
2. Demonstrate working of lexical analysis.

Module 2: Syntax Analysis

1. Discuss the role of Syntax analyzer in the compilation process.
2. Demonstrate Top-Down and Bottom-up parsing techniques

Module 3: Syntax Directed Translation & Run time environments

1. Analyze the working of various three address code representation for intermediate code representation
2. Discuss the importance of syntax directed translation in compiler design

Module 4: Intermediate Code Generation

1. Demonstrate intermediate code generation phase in compiler design.

Module 5: Code Optimization

1. Demonstrate the code optimization during compiler construction

Module 6: Code Generation

1. Discuss various issues and algorithms involved in code generation phase of a compiler
2. Assess six phases of compiler using compiler design tools and techniques.

Title of the Course: Design and Analysis of Algorithm Course code: 4CS302	L	T	P	Cr
	3	-	-	3

Desirable requirements: Data structure

Textbooks:

1. Ellis Horowitz, Sartaj Sahni and Rajasekaran “Fundamentals of Computer Algorithms” , Galgotia Publications, 2nd Edition.
2. Aho, Hopcraft 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 McGraw Hill.

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

Course Learning Outcomes:

CO	After the completion of the course the student should be able to	Bloom’s Cognitive	
		Level	Descriptor
CO1	Discuss the fundamentals of algorithm design and analysis techniques.	2	Understanding
CO1	Apply knowledge of computing and mathematics to algorithm design	3	Applying
CO3	Critically analyze the various algorithm design techniques for a given problem.	4	Analyzing
CO4	Classify computational problems into P, NP, NP-Hard and NP-Complete.	5	Evaluating
CO5	Design efficient algorithms to improve complexity of existing algorithm.	6	Creating

CO-PO Mapping :

PO and PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2													
CO2	3	1												
CO3		3		2										
CO4				2										
CO5			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% weightage respectively.

Assessment	Marks
ISE 1	10
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ISE 2	10
ESE	50

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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.
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.	
Module 2: Divide and conquer	7 Hrs.
Binary Search, Merge sort , Quick sort , Heap Sort , Multiplication of Large Integers, Closest-Pair and Convex, Hull Problems, Strassen’s Matrix Multiplication.	
Module 3: Greedy Technique	6 Hrs.
Greedy Technique – Container loading problem, Job sequencing with deadlines, Minimum cost spanning trees, Knapsack problem, Optimal Merge pattern, Huffman Trees.	
Module 4: Dynamic Programming	7 Hrs.
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.	
Module 5: Backtracking	6 Hrs.
Backtracking-General method, applications The 4, 8-queen problem, sum of subsets problem, graph coloring, Hamiltonian cycles.	
Module 6: Graph Traversal Techniques & Class of problem	7 Hrs.
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.	

Module wise Measurable Students Learning Outcomes :

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

Module 1: Define fundamental notation of algorithm representation and discuss complexity calculation

methods

Module 2: Apply divide and conquer approach to solve real world problem

Module 3: Provide solution to given problem by identifying optimal greedy algorithm

Module 4: Study Dynamic Programming method and identify the various problems which can be solved by using Dynamic programming

Module 5: Identifying various problem which are optimally solvable using backtracking approach

Module 6: Compare BFS and DFS graph traversal techniques by solution various problem. Discuss and classify complexity class analyzing complexity of different problem

Title of the Course: Computer Graphics		L	T	P	Cr
Course code: 4CS303		2	0	0	2
Pre-Requisite Courses: C/C++ Programming, Data Structures & Files, Java Programming					
Textbooks:					
<ol style="list-style-type: none"> 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:					
<ol style="list-style-type: none"> 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 7. 					
Course Objectives:					
<ol style="list-style-type: none"> 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 Learning Outcomes:					
CO	After the completion of the course the student should be able to	Bloom’s Cognitive			
		level	Descriptor		
CO1	Perceive the fundamental concepts of Computer Graphics.	2	Understanding		
CO2	Handle different transformation algorithms.	3	Applying		
CO3	Execute 2D Clipping Algorithms	3	Applying		
CO4	Appraise acquired transformations with projection using modern tools.	4	Analyzing		
CO5	Rehash technique of computer animation and its relationship with image and storage.	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	--	--	--	--	--	--	--	--	--	--	1	--
CO2	3	2	2	--	--	--	--	--	--	--	--	--	1	--
CO3	2	2	3	--	--	--	--	--	--	--	--	--	--	--
CO4	1	2	2	--	3	--	--	--	--	--	--	--	--	--
CO5	1	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% 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 with 70-80% weightage for course content (normally last three modules) covered after MSE

Course Contents:

Module 1 Introduction to computer Graphics	Hrs.
Introduction to computer graphics: Definition, Input and output Devices, Introduction to graphics primitives such as points, lines, polygons, etc.; representation of pictures using primitives; storage & retrieval of pictures; . Rasterization techniques: Line – DDA; Bresenham’s generalized integer version; Mid-point rasterization. Circle – Bresenham’s algorithm; Mid-Point algorithm 1st order difference & 2nd order difference methods.	4
Module 2 2D and 3D introduction	Hrs.
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. 2D Geometric transformations: Introduction to representation of 2D objects as matrices; transformation matrices for scaling, shear, rotation, reflection 3D Geometric transformations: Introduction to representation of 3 D objects as matrices; transformation matrices for scaling, shear, rotation, reflection	5
Module 3 2D Clipping	Hrs.
Clipping against regular window – Explicit line clipping; Sutherland & Cohen line clipping, Mid-point subdivision line clipping; Sutherland & Hodgemann polygon clipping.	4
Module 4 Projection	Hrs.
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

Module 5 Computer Animation	Hrs.
Introduction, Key frame animation, Construction of an animation sequence, Motion control methods, Procedural animation, Key-frame animation vs. Procedural animation, Introduction to Morphing, Wrapping techniques, Three dimensional morphing.	5
Module 6 Image Manipulation and Storage	Hrs.
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
<p>Module wise Measurable Students Learning Outcomes : After the completion of the course the student should be able to: Module wise Measurable Students Learning Outcomes: After the completion of the course the student should be able to: The student after completing the course will be able to:</p> <p>Module 1 1. Differentiate Vector & Raster graphics. 2. Draw graphic entities with maximum correctness over screen alias.</p> <p>Module 2 1. Represent the object in plane/space coordinate system. 2. Animate the object with linear and rotational move.</p> <p>Module 3 1. Color objects with different filling algorithms and compare their time & space requirements. 2. Display images on discrete computer screens with minimum possible errors.</p> <p>Module 4 1. View objects in parallel, perspective mode; as well eliminate the invisible edges & surfaces. 2. Decide upon what to and where to display on the comp. screen.</p> <p>Module 5 1. Draw axis/parameter dependent mathematical curve paths. 2. Understand their applications in the field of design, engineering, manufacturing, animation etc.</p> <p>Module 6 1. Different image formats. 2. Have primary efforts towards lighting, shading, rendering, texturing the objects.</p>	

ODD Semester

Professional Core (Lab) Courses

Title of the Course: Design and Analysis of Algorithm Lab	L	T	P	Cr
Course code: 4CS352	-	-	2	1

Desirable requirements: Data structure

Textbooks:

1. Ellis Horowitz, Sartaj Sahni and Rajasekaran “Fundamentals of Computer Algorithms” , Galgotia Publications, 2nd Edition.
2. Aho, Hopcraft 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 McGraw Hill.

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 above methods.

Course Learning Outcomes:

CO	After the completion of the course the student should be able to	Bloom’s Cognitive	
		level	Descriptor
CO1	Practice different algorithm techniques for given problem.	3	Applying
CO2	Identify appropriate data structure to implement selected algorithmic approach	4	Analyzing
CO3	Design and Implement an algorithm for complex problem in polynomial time.	6	Creating
CO4	Exhibit technical and professional skill to demonstrate and convince accomplished algorithmic solution.	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										
CO3			3	1										
CO4				2				2	2	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 Submission at the end of Week 5	25
LA2	Lab activities, attendance, journal	Lab Course Faculty	During Week 5 to Week 8 Submission at the end of Week 9	25
LA3	Lab activities, attendance, journal	Lab Course Faculty	During Week 10 to Week 14 Submission at the end of Week 14	25
Lab ESE	Lab Performance and related documentation	Lab Course faculty	During Week 15 to Week 18 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.

Laboratory 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 and compare.
5. To apply Greedy method to solve problems of
 - a) Job sequencing with deadlines
 - b) Optimal storage on tapes

6. Implement the following using Dynamic Programming
 - a) Matrix-chain multiplication
 - b) Longest common subsequence
 - c) Optimal binary search trees
7. To implement Strassen's matrix multiplication algorithm
8. From a given vertex in a weighted connected graph, find shortest paths to other vertices using Dijkstra's algorithm.
9. Find a subset of a given set $S = \{s_1, s_2, \dots, s_n\}$ of n positive integers whose sum is equal to a given positive integer d . For example, if $S = \{1, 2, 5, 6, 8\}$ and $d = 9$ there are two solutions $\{1, 2, 6\}$ and $\{1, 8\}$. A suitable message is to be displayed if the given problem instance doesn't have a solution.
10. Implement any scheme to find the optimal solution for the Traveling Salesperson problem and then solve the same problem instance using any approximation algorithm and determine the error in the approximation.
11. Implement the following using Back Tracking
 - a) 8-Queen's problem
 - b) Hamiltonian cycle
 - c) Graph coloring Problem
12. Write a program to
 - a) Print all the nodes reachable from a given starting node in a digraph using BFS method.
 - b) Check whether a given graph is connected or not using DFS method.
13. Implement All-Pairs Shortest Paths Problem using Floyd's algorithm. Parallelize this algorithm by creating multiple threads and determine the speed-up achieved.
14. Compare and evaluate the performance of different Randomization and Approximation algorithms.

Title of the Course: Computer Graphics Lab Course code: 4CS353		L	T	P	Cr
		0	0	2	1
Pre-Requisite Courses: C/C++ Programming, Data Structures & Files, Java Programming					
Textbooks:					
<ol style="list-style-type: none"> 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:					
<ol style="list-style-type: none"> 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 					
Course Objectives:					
<ol style="list-style-type: none"> 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 Learning Outcomes:					
CO	After the completion of the course the student should be able to	Bloom’s Cognitive			
		level	Descriptor		
CO1	Outline the fundamental concepts of Computer Graphics.	2	Understanding		
CO2	Illustrate the fundamental concepts of computer graphics with its different transformations using algorithms.	3	Applying		
CO3	Solve different algorithms on 2D clipping	3	Applying		
CO4	Investigate acquired transformations with projection.	4	Analyzing		
CO5	Scrutinize technique of computer animation and figure out relation with image and storage.	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	1	--	--	--	--	--	--	--	--	--	--	--
CO2	3	2	1	2	--	--	--	--	--	--	--	--	--	--
CO3	--	2	1	-	2	--	--	--	--	--	--	--	3	--
CO4	1	2	1	2	3	--	--	--	--	--	--	2	--	--
CO5	1	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 Submission at the end of Week 5	25
LA2	Lab activities, attendance, journal	Lab Course Faculty	During Week 5 to Week 8 Submission at the end of Week 9	25
LA3	Lab activities, attendance, journal	Lab Course Faculty	During Week 10 to Week 14 Submission at the end of Week 14	25
Lab ESE	Lab Performance and related documentation	Lab Course faculty	During Week 15 to Week 18 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.

Practicals:

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

Title of the Course: Mini Project 1			L	T	P	Cr								
Course code: 4CS341			-	-	2	1								
Desirable requirements: Nil														
Textbooks: Nil														
References:														
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 Learning Outcomes:														
CO	After the completion of the course the student should be able to					Bloom's Cognitive								
						level	Descriptor							
CO1	recognise present technological trends through seminar and presentation					1	Remembering							
CO2	articulate the appropriate selection of software tool for project implementation.					2	Understanding							
CO3	engage in teams and produce group activities of software development					3	Applying							
CO4	develop a software product and demonstrate its significance					4,5	Analyzing,Evaluating							
CO-PO Mapping :														
PO and PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1											3			3
CO2		3		3										3
CO3			3	2		3	2							2
CO4		3										3		
<i>1: Low, 2: Medium, 3: High</i>														

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 Submission at the end of Week 5	25
LA2	Lab activities, attendance, journal	Lab Course Faculty	During Week 5 to Week 8 Submission at the end of Week 9	25
LA3	Lab activities, attendance, journal	Lab Course Faculty	During Week 10 to Week 14 Submission at the end of Week 14	25
Lab ESE	Lab Performance and related documentation	Lab Course faculty	During Week 15 to Week 18 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:

1. Students should maintain a project log book containing weekly progress of the project
2. At the end of the semester project group should achieve all the proposed objectives of the problem statement.
3. The work should be completed in all aspects of design, implementation and testing.
4. Project report should be prepared and submitted in soft and hard form along with all the code and datasets.
5. Group should demonstrate the work with various test cases and results obtained and explain future scope.
6. The group should participate in technical symposiums, paper presentations to demonstrate their work and findings in technical community.

Title of the Course: Programming Lab 3	L	T	P	Cr
Course code: 4CS354	0	0	4	2

Desirable Requirement: Basics of Object-Oriented Programming

Textbooks:

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

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.

Online References:

1. <https://www.w3schools.com/>
2. <https://www.javatpoint.com/>
3. <https://developer.mozilla.org/en-US/docs/Web>

Course Objectives:

Summary:

World Wide Web (WWW) is an information storing, retrieval and sharing system/service where web resources such as documents, audios, videos, images, etc. are identified by Uniform Resource Locator (URL), which may be interlinked by hypertext and are accessible over the Internet.

Many web programming languages are required to create web pages that may be published on the WWW. This course introduces some of them, such as Hyper Text Markup Language (HTML), Cascading Style Sheet (CSS), Client-side scripting language – JavaScript and library of JavaScript, server-side scripting language – PHP or Node.js or any other state-of-the-art, Data Interchange Formats - XML and JSON, and AJAX. The course also introduces the basics of web security. Students will learn these technologies and tools and will be able to develop websites for individual learning and for socio-economic cause.

Following are the objectives of this course:

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 Learning Outcomes:

CO	After the completion of the course the student should be able to	Bloom's Cognitive	
		level	Descriptor
CO1	summarize the different concepts and components of WWW, web development technologies and web security.	2	Understanding
CO2	illustrate the concepts of different web development technologies using different web development tools.	3	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.	4	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.	5	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.	6	Creating

CO-PO Mapping: (Use 1,2,3 as correlation strengths)

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	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

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 Submission at the end of Week 5	25
LA2	Lab activities, attendance, journal	Lab Course Faculty	During Week 5 to Week 8 Submission at the end of Week 9	25
LA3	Lab activities, attendance, journal	Lab Course Faculty	During Week 10 to Week 14 Submission at the end of Week 14	25
Lab ESE	Lab Performance and related documentation	Lab Course faculty	During Week 15 to Week 18 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 World Wide Web	Hrs.
Client, Server, Communication, Protocols, Ports, Client-Server Architectures, Internet, World Wide Web, HTTP, HTTP Status Codes, Web Clients/Browsers, and Web Servers. Experiments: <ol style="list-style-type: none">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.	4
Module 2: Markup Languages and Building Web Pages	Hrs.
Introduction to Markup Languages, Introduction to HTML and HTML5, Fundamental HTML Elements, HTML Forms, HTML Media, HTML Graphics, HTML APIs, HTML Web Components. Experiments: <ol style="list-style-type: none">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.5. Design and develop web pages that embed audio and video.6. Design and develop web pages that embed links.7. Design and develop web pages that embed lists and tables.8. Design and develop web pages with styles, semantics and layouts, such as header, footer, section, data, div, etc.9. Design and develop web pages to embed YouTube videos.10. Design and develop web pages that embed graphics using canvas and SVG.11. Design and develop web pages using HTML APIs.12. Design and develop web pages using web components.	10
Module 3: Style sheet Languages and Presentation of Web Pages	Hrs.
Introduction to style sheet languages, Introduction to Cascading Style Sheet (CSS), Text Formatting, Colors and Backgrounds, Borders and Margins, Floating and Positioning, Page Layout, Navigation Bars and Dropdowns, CSS Selectors. Experiments: <ol style="list-style-type: none">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 color, 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.	8

<ol style="list-style-type: none"> 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	Hrs.
<p>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.</p> <p>Experiments:</p> <ol style="list-style-type: none"> 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. 	10
Module 5: Server-side Programming	Hrs.
<p>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.</p> <p>Note:</p> <ol style="list-style-type: none"> 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. <p>Experiments:</p> <ol style="list-style-type: none"> 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. 	

<ol style="list-style-type: none"> 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	Hrs.
<p>XML: Introduction to XML, Basics of XML, DTD, Namespaces, XHTML, XPath, XLinks, XQuery and XSLT.</p> <p>JSON: Introduction to JSON, JSON vs XML, Syntax, Data Types, Parse, Stringify, Objects and Arrays, JSON in HTML.</p> <p>AJAX: Introduction to AJAX, XMLHttpRequest, AJAX XML, AJAX PHP, and AJAX Database.</p> <p>Web Security: Introduction, types of web threats, and prevention measures.</p> <p>Experiments:</p> <ol style="list-style-type: none"> 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. 	10

ODD Semester

Professional Elective (Theory) Courses

Title of the Course: Machine Learning	L	T	P	Cr
Course code: 4CS311	3	0	0	3

Pre-Requisite Courses: Basic Programming, Probability theory and linear algebra

Textbooks:

1. T. Hastie, R. Tibshirani, J. Friedman. The Elements of Statistical Learning, 2e, 2008
2. Christopher Bishop. Pattern Recognition and Machine Learning. 2e.

References:

1. Tom M. Mitchell, Machine Learning, McGraw-Hill
2. <http://nptel.ac.in>

Course Objectives :

1. To introduce some of the basic concepts of machine learning from a mathematically well motivated perspective
2. To cover the different machine learning paradigms and some of the popular algorithms and architectures used in each of these paradigms

Course Learning Outcomes:

CO	After the completion of the course the student should be able to	Bloom's Cognitive	
		level	Descriptor
CO1	explain fundamental issues and challenges and algorithms of machine learning	2	Understanding
CO2	demonstrate and use various algorithms and models with the mathematical justifications	3	Applying
CO3	measure strengths and weaknesses of various machine learning approaches and use appropriate machine learning algorithms for real-world applications.	5	Evaluating

CO-PO Mapping :

PO and PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	2												
CO2	1												1	
CO3				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	7 Hrs.
Introduction to Machine Learning, Concepts of Supervised and Unsupervised Learning, Statistical Decision Theory : Linear and Multivariate Regression, Dimensionality Reduction	
Module 2 : Linear Classification and SVM	6 Hrs.
Linear Classification, Linear Discriminant Analysis, Support Vector Machine	
Module 3 : Bayesian Learning and Decision Trees	7 Hrs.
Maximum Likelihood estimate, Priors and MAP estimate, Decision Trees	
Module 4 : Evaluation Measures and Hypothesis Testing	6 Hrs.
Evaluation Measures, Bootstrapping and cross validation, ROC curve Hypothesis Testing : Basics, Sampling Distributions and Z test, t-test	
Module 5 : Graphical and Gaussian Mixture Models	7 Hrs.
Graphical Models : Bayesian Networks, Hidden Markov Models Learning Theory and Expectation Maximization: Gaussian Mixture Model, Expectation Maximization	
Module 6 : Reinforcement Learning	6 Hrs.
Introduction to Reinforcement Learning, RL framework and TD learning, Applications	

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

Module 1: Explain fundamentals of machine learning and decision theory

Module 2: Demonstrate the knowledge of Linear classification, support vector machines

Module 3: Demonstrate and use the concepts of Bayesian Learning and decision trees

Module 4: Explain and apply evaluation measures and hypothesis testing for problem solving

Module 5: Explain and use Graphical and Gaussian mixture models of machine learning

Module 6: Explain reinforcement learning, its framework and practical applications

Title of the Course: Digital Image Processing Course code: 4CS312	L	T	P	Cr
	3	-	-	3

Desirable requirements:

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.

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 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 Learning Outcomes:

CO	After the completion of the course the student should be able to	Bloom's Cognitive	
		level	Descriptor
CO1	Discuss general terminology of digital image processing.	2	Understanding
CO2	Apply and demonstrate image processing algorithms in practical applications	4	Applying
CO3	Illustrate and critique different techniques employed for the enhancement, segmentation, morphology and compression of images	5	Evaluating

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											
CO3	1			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% weightage 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.
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Course Contents:

Module 1: Digital Image Fundamentals	6 Hrs.
Introduction and applications, Fundamental Steps and Components of Image Processing System Digital Image Fundamentals: Image Acquisition, A simple image model, Sampling and Quantization, Imaging Geometry, Different types of digital images	
Module 2: Image Transforms	6 Hrs.
2D systems and Necessary Mathematical preliminaries, 2D Orthogonal and Unitary Transforms, DFT, KL-Transforms, Cosine, Hadamard Transforms, Introduction to Wavelet Transforms	
Module 3: Image Enhancement	6 Hrs.
Point Processing, Basic Gray Level Transformations, Histogram Processing, Spatial domain Filtering, Frequency domain filtering	
Module 4: Image Segmentation and Analysis	8 Hrs.
Edge Detection – using first and second order derivatives, LoG, Canny edge detector, Boundary Extraction – Connectivity, Heuristic Graph Search, Hough Transform, Active Contour, Watershed Transform, Region-based Segmentation – region growing, region splitting and merging, Feature Extraction	
Module 5: Morphological Image Processing	7 Hrs.
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	
Module 6: Image Compression	6 Hrs.
Fundamentals, Compression model, Lossless Vs Lossy Compression, Fundamentals of Information Theory, Run-length coding, Huffman coding, Dictionary-based compression, Predictive coding, Transform-based coding, Image Compression Standards	

Module wise Measurable Students Learning Outcomes :

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

Module 1

Describe the fundamental concepts of Image Processing and its applications.

Module 2

Explain Image Processing Transforms which play significant role in image enhancement, filtering, analysis and compression.

Module 3

Implement various techniques to improve the quality of an image.

Module 4

Explain segmentation which is one of the most important steps leading to image analysis, learning and implementing various methods to divide an image into parts or groups of pixels which are homogeneous with respect to some criterion.

Module 5

Describe fundamentals of Morphological Image Processing and its operations

Module 6

Explain the need of image compression i.e. the technique of reducing the amount of data required to represent a digital image.

Title of the Course: Internet(Web) of Things	L	T	P	Cr
	3	-	-	3
Course code: 4CS313				

Desirable Requirements:

Textbooks:

1. Shriram K Vasudevan, Abhishek S Nagarajan, RMD Sundaram, "Internet of Things", Wiley, 2019.
2. Pethuru Raj and Anupama C. Raman, "The Internet of Things: Enabling Technologies, Platforms, and Use Cases", CRC Press.

References:

1. Stefan Poslad, "Ubiquitous Computing: Smart Devices, Environments and Interactions", Wiley, 2009.
2. Arshdeep Bahga and Vijay Madisetti "Internet of Things: A Hands-on Approach", Universities Press.

Course Objectives :

1. Enrich students with the new revolutionary pervasive ubiquitous computing knowledge.
2. Unleash the prerequisites and concepts enabling Internet of Things.
3. Explore protocols, architectures, communication technologies & devices of Internet of Things.
4. Acquaint learners with the successful case studies of potential applications of Internet of Things.

Course Learning Outcomes:

CO	After the completion of the course the student should be able to	Bloom's Cognitive	
		level	Descriptor
CO1	cognize with the concepts of Internet of Things.	2	Understanding
CO2	explore the architecture, various protocols used in enabling Internet of Things frameworks.	4	Analyzing
CO3	articulate and appraise hands on experiments in Internet of Things.	5	Evaluating
CO4	prepare aptitude to implement concepts of Internet of Things technologies in real life applications.	6	Creating

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	PO11	PO12	PSO1	PSO2
CO1	3	1												
CO2			1	1										
CO3					2									
CO4				3		1	1						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	Hrs.
Introduction to IoT: Concepts- Things in IoT, Principles, Characteristics , Benefits, IoT Stack Layers, Enabling Technologies, Challenges, IoT Levels	5
Module 2	Hrs.
Sensors, Protocols & Wireless communication for IoT: Sensor types, Protocol Standardization for IoT, MQTT, CoAP, IPv6, URI, M2M and WSN Protocols – SCADA and RFID Protocols. Machine-to-Machine Communications	6
Wireless Communications: IEEE802.11 Standards, BLE, Zigbee, Context aware sensor networks.	
Issues with IoT Standardization – Unified Data Standards	
Module 3	Hrs.
Development & Embedded Technologies Interoperability in IoT: Introduction to Arduino Programming, Integration of Sensors and Actuators with Arduino IDE, Raspberry Pi Architecture, Configuration and programming, Python support.	7
Module 4	Hrs.
IoT Cloud Platforms: Introduction, Types, Various application development platforms viz AWS, Azure, Adafruit, ThinkSpeak, Ubidots etc , Architecture , IoT with Cloud Challenges, Selection of Cloud service provider for IoT applications overview, Fog Computing, Online databases viz Firebase	6

Module 5	Hrs.
IoT Architectures & Governance: Standard Architectures, Resource Management in the IoT, IoT Privacy, Security and Governance challenges. Profile user identification techniques viz RFID, Image processing.	5
Module 6	Hrs.
Internet of Things Application Scenarios: Smart Transportation, infrastructure, Health care systems, Smart City automation, Home automation, Tracking, Over-The-Air passive surveillance, Control application examples, Heating ventilation and Air conditioning applications.	5
Module wise Measurable Students Learning Outcomes : Module wise Outcomes At end of each module students will be able to, Module 1: cognize with the fundamental concepts of IoT, such as principles, characteristics , benefits, IoT stack layers, enabling technologies, challenges and Levels. Module 2: Explore and be able to analyse knowledge of Sensors,Protocols & Wireless communication used in IoT technology. Also realizes the Issues with IoT Standardization. Module 3: experiment development using embedded technologies such as Arduino and Raspberry Pi in detail with Python support. Module 4: exposed to IoT Cloud Platforms, with exploration on types, Various application development platforms , architecture , challenges, how to select cloud service provider application wise. Also students will grab brief knowledge about latest Fog Computing and online databases. Module 5: aware about standardization , resource Management , privacy, security and Governance challenges. Also brief know-how on profile user identification techniques. Module 6: taught to potential application Scenario as case studies so as to realize how to apply IoT learning to meet suitable cross domain societal challenges.	

ODD Semester

Open Electives Courses

Title of the Course: Software Engineering and Database Essentials Course code: 4OE371	L	P	T	CR
	3	0	0	3

Pre-Requisite Courses:-NIL

Textbooks:

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

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 Learning Outcomes:

CO	After the completion of the course the student should be able to	Bloom’s Cognitive	
		level	Descriptor
CO1	explain proficiency to undertake software projects based on software engineering practices.	2	Understanding
CO2	summarizing the spirit of team-working in SDLC phases & project planning benefits.	2	Understanding
CO3	describe the conceptual designs of Database, identifies the need, analyze the problem and Design ER diagram as well as prepare the relational database schema.	1,4	Remembering, Analyzing
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.	4	Analyzing.

CO-PO Mapping : 1: Low, 2: Medium, 3: High

PO and PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1
CO1	3					2	1						3
CO2			3						3		1		
CO3			3	1									
CO4		2		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 60-70% weightage for course content (normally last three modules) covered after MSE.

Course Contents:**Module 1: Introduction Software Engineering Basics:****7 Hrs.**

Software Crisis, Need of software engineering approach.

Software Processes:

Software Processes: project management process, software development process models, Configuration management process, process management process.

Module 2: Software Quality & Project Planning**6 Hrs.****Notion of Software Quality:**

Quality objectives, Need for improvement, Software quality factors, Quality standards,

Project Planning Basics:

Project management plan, Cost estimation, Project scheduling, Staffing and personnel Planning, Risk management.

Module 3: Software Development Phases**6 Hrs.**

Software Requirement Process, Design principles, Structured design methodology,

Coding Standards, levels of Testing.

Module 4: Introduction and Database Modeling 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.

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

<p>Module 5: Relational Model and SQL</p> <p>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,</p> <p>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.</p>	<p>8 Hrs.</p>
<p>Module 6: Database Architectures</p> <p>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.</p>	<p>6 Hrs.</p>
<p>Module wise Measurable Students Learning Outcomes :</p> <p>The student after completing the course will be able to:</p> <p>Module 1: Introduction Software Engineering</p> <ul style="list-style-type: none"> • Awareness of Software processes & Models used at IT. <p>Module 2: Software Quality & Project Planning</p> <ul style="list-style-type: none"> • Understand quality parameters and standards. • Know project planning phases and responsibilities. <p>Module 3: Software Development Phases</p> <ul style="list-style-type: none"> • 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. • Know testing concepts, levels of testing <p>Module 4: Introduction and Database Modeling using ER Model</p> <ul style="list-style-type: none"> • Understanding the concept of database system and its applications. • Studying database system architecture and various database models. • Understanding the problem statement and preparing the conceptual model using ER diagram. <p>Module 5: Relational Model and SQL</p> <ul style="list-style-type: none"> • Studying relational data model using any RDBMS. • Extracting information from the database using SQL <p>Module 6: Parallel and Distributed Databases and C/S architectures</p> <ul style="list-style-type: none"> • Awareness of Database Architectures and its operation. 	

ODD Semester

Minor Specialization Courses

Title of the Course: Database Engineering Course code: 1CSM03	L	T	P	Cr
	3	0	0	3

Desired requirements: Data structure

Textbooks:

Abraham Silberschatz, Henry F. Korth and S. Sudarshan, “Database System Concepts”, Mc-Graw Hill, 4th Edition 2002 / 6th Edition 2011/ 7th Edition

References:

1. Raghu Ramakrishnan and Johannes Gehrke, Database Management Systems, 3rd Edition. 2002
2. Ramez Elmasri and Shamkant Navathe, Benjamin Cummings, Fundamentals of Database Systems, 3rd Edition, 1999 / later

Course Objectives :

1. To enable the students to understand various functional components of database system and basic concepts of conceptual database design.
2. To use conceptual designs to prepare database schemas.
3. To make the students understand the relational model and the theoretical issues associated with relational database design.
4. To make the students learn and use SQL, understanding of essential DBMS concepts such as: database security, indexing, transaction processing, and concurrency.

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 database management system	2	Understanding
CO2	Apply ER model and relational model for database design of given problem	3	Applying
CO3	Demonstrate SQL query using open source or commercialize database.	3	Applying
CO4	Illustrate the fundamentals for database storage, indexing, transaction and concurrency control	2	Understanding

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	PSO 1	PSO 2
CO1	1												1	
CO2		2												
CO3					3								1	
CO4	1	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	Hrs. 5
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.	
Module 2 Database Modelling using ER Model	Hrs. 7
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 3 Relational Model & SQL	Hrs. 8
Structure of Relational Database, Reduction of ER model into Relational schemas, Schema-instance distinction, Referential integrity and foreign keys. Introduction to SQL, Data definition statements with constraints, Insert, Update and Delete, Set Operations, Aggregate functions group by and having clauses	
Module 4 Relational Database Design	Hrs. 7
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	
Module 5 Data Storage and Indexing	Hrs. 5
File organization, Organization of records in files, Data Dictionary, Database Buffer, and Indexing: Concept, Ordered Indices-Primary, Secondary	
Module 6 Transaction, Concurrency Control and Database security	Hrs. 7
Transaction processing: Concept, ACID properties, Transaction states , Serializability Concurrency control: Lock-based protocols, Timestamp - based Protocols, Database security: Authentication, Authorization and access control, Discretionary Access Control (DAC), Mandatory Access Control (MAC)	
Module wise Measurable Students Learning Outcomes :	
After the completion of the course the student should be able to:	
Module 1	
<ul style="list-style-type: none"> • explain the concept of database system and its applications. • demonstrate database system architecture and various database models. 	
Module 2	
<ul style="list-style-type: none"> • understand the problem statement and preparing the conceptual model using ER diagram.. 	
Module 3	
<ul style="list-style-type: none"> • describe and implement relational data model using any RDBMS.. • extract information from the database using SQL, compare various SQL constructs 	
Module 4	
<ul style="list-style-type: none"> • demonstrate and use the concept of functional dependency and various normal forms for “good” database design 	
Module 5	
<ul style="list-style-type: none"> • explain file organization concepts and various indexing techniques 	
Module 6	
<ul style="list-style-type: none"> • explain the concept of transaction and implement transactions. • describe and compare various concurrency control mechanisms and apply the concepts for hands-on experimentation. • Illustrate different aspect of database security 	

EVEN Semester

EVEN Semester

Professional Core (Theory) Courses

Title of the Course: Cloud Computing Course code: 4CS321	L	T	P	Cr
	3	-	-	3

Desirable Requirements: Operating system, Computer Networks

Textbooks:

1. Rajkumar Buyya, James Broberg, Andrzej M. Goscinski ,”Cloud Computing: Principles and Paradigms”, Wiley, 1 Edition 2013
2. Gautam Shroff, ”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

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 Learning Outcomes:

CO	After the completion of the course the student should be	Bloom’s Cognitive	
		level	Descriptor
CO1	Distinguish concepts of distributed paradigm from other computing paradigm and the mechanism of inter process communication in distributed systems.	2	Understanding
CO2	Describe main concepts, key technologies, strengths, and limitations of cloud computing and the possible applications for state-of-the-art cloud computing.	2	Understanding
CO3	Illustrate different cloud infrastructure models, cloud computing architecture and various deployment models.	3	Applying
CO4	Classify different hypervisors and virtualization techniques based on their characteristics.	4	Analyzing
CO5	Identify core issues of cloud computing such as security, privacy, and interoperability.	4	Analyzing
CO6	Examine the components of Open and commercial cloud platform	4	Analyzing

CO-PO Mapping :

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1													
CO2		2											2	
CO3		2											1	
CO4		2											1	
CO5		2											1	
CO6		2	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:

<p>Module 1: Principles of distributed computing 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.</p>	Hrs. 7
<p>Module 2: Introduction to Cloud Computing 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.</p>	Hrs. 5
<p>Module 3: Cloud Computing Architecture 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: Public cloud, Private cloud, Hybrid cloud, Community cloud.</p>	Hrs. 7
<p>Module 4: Virtualization Introduction, characteristics of virtualized environments, Taxonomy of virtualization Techniques, Virtualization and cloud computing, Pros and Cons of virtualization, technology Examples.</p>	Hrs. 6
<p>Module 5 : Cloud Security 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</p>	Hrs. 6
<p>Module 6: Case Study on Open Source & Commercial Clouds Eucalyptus ,Microsoft Azure ,Amazon EC2,Google App Engine, Open Stack, Open Nebula</p>	Hrs. 8

Module wise Measurable Students Learning Outcomes :

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

Module 1: Describe elements of distributed computing along with concepts inter process communication paradigm

Module 2: Describe advantage of cloud computing over grid computing

Module 3: Demonstrate models of cloud deployment and services offered by cloud model

Module 4: Distinguish among available virtualization techniques

Module 5. Discuss and Identify security and privacy issues in cloud computing.

Module 6. Deploy and analyse applications over commercial cloud computing infrastructures such as Amazon Web Services, Windows Azure, and Google AppEngine. Also demonstrate open source cloud building software

Title of the Course: Advanced Database System Course code: 4CS322	L	T	P	Cr
	3	0	0	3

Desirable requirements : Database Engineering

Textbooks:

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

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 Learning Outcomes:

CO	After the completion of the course the student should be able to	Bloom’s Cognitive	
		level	Descriptor
CO1	Exploit the fundamental concepts involved in advanced databases and apply it in complex data handling.	3	Applying
CO2	Analyze the architectures and performance of different databases using modern tools for domain specific applications.	4	Analyzing
CO3	Recommend the optimal database based solution to solve real world problem.	5	Evaluating
CO4	Apply the acquired knowledge in databases to design and build the different business applications.	6	Creating

CO-PO Mapping :

PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO11	PO12	PSO1	PSO2
CO1	3												2	
CO2					2								2	2
CO3			2										2	
CO4			3										1	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% 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 with 70-80% weightage for course content (normally last three modules) covered after MSE

Course Contents:

Module 1 Object-Based Databases	Hrs.
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
Module 2 Application development & Administration	Hrs.
Application Programs and User Interfaces, Application Architectures, Standardization , Rapid Application Development, Application Performance, Application Security. Performance Tuning, Performance Benchmarks, Other issues in Application Development	7
Module 3 Parallel and Distributed databases	Hrs.
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
Module 4 Cloud Databases – I	Hrs.
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
Module 5 Cloud Databases – II	Hrs.
Case study of following NoSQL databases : Voldemort , MongoDB , Cassandra , Neo4J , Cloud Native , Data Lake	8
Module 6 Spatial, Temporal Data and Mobility	Hrs.
Motivation, Time in Databases, Spatial and Geographic Data, Multimedia Databases, Mobility and Personal Databases.	6

Module wise Measurable Students Learning Outcomes :

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

Module 1

1. **Describe** the fundamental concepts involved in object databases
2. **Apply** the concept in complex data handling.

Module 2

1. **Make** use of acquired knowledge to build and demonstrate the different business applications.
2. **Devise** the performance of the enterprise application

Module 3

1. **Evaluate** parallel and distributed databases
2. **Analyze** their performance for enterprise application

Module 4

1. **Explain** cloud database architecture and data models
2. **Compare** it with relational database

Module 5

1. **Illustrate** different open source cloud database
2. **Design** and build the applications using cloud database

Module 6

1. **Explain** the advances in databases beyond the traditional models
2. **Discuss** and evaluate the temporal , spatial and multimedia databases

EVEN Semester

Professional Core (Lab) Courses

Title of the Course: Advanced Database System Lab Course code: 4CS372	L	T	P	Cr
	0	0	2	1

Desirable requirements : Database Engineering

Textbooks:

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

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 Learning Outcomes:

CO	After the completion of the course the student should be able to	Bloom’s Cognitive	
		level	Descriptor
CO1	Scrutinize different database servers, application architectures / models, frameworks and identify optimal one, suitable for particular application.	4	Analyzing
CO2	Select the advanced/modern databases and recommend for prediction and modeling of complex real world data.	5	Evaluating
CO3	Design and build the different enterprise applications using modern tools.	6	Creating

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	PO11	PO12	PSO1	PSO2
CO1				2									2	
CO2					2								2	
CO3					3						1		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 Submission at the end of Week 5	25
LA2	Lab activities, attendance, journal	Lab Course Faculty	During Week 5 to Week 8 Submission at the end of Week 9	25
LA3	Lab activities, attendance, journal	Lab Course Faculty	During Week 10 to Week 14 Submission at the end of Week 14	25
Lab ESE	Lab Performance and related documentation	Lab Course faculty	During Week 15 to Week 18 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

1. Minimum 12 assignments or 6 mini-projects should be practice/performance based on the understanding of concepts covered in theory course.
2. The detail list of assignments/mini-projects will be displayed 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.

Title of the Course: Mini Project 2														
Course code: 4CS342					L	T	P	Cr						
					-	-	2	1						
Desirable requirements: Nil														
Textbooks:														
Nil														
References:														
Course Objectives :														
<ol style="list-style-type: none"> 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 Learning Outcomes:														
CO	After the completion of the course the student should be able to							Bloom's Cognitive						
								level	Descriptor					
CO1	recognise present technological trends through seminar and presentation.							1	Remembering					
CO2	articulate the appropriate selection of software tool for project implementation.							2	Understanding					
CO3	engage in teams and produce group activities of software development.							3	Applying					
CO4	develop a software product and demonstrate its significance							4, 5	Analysing, Evaluating					
CO-PO Mapping :														
PO and PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1		3								3				
CO2			2		3									
CO3								2	3	3				
CO4		3					2				3			3
<i>1: Low, 2: Medium, 3: High</i>														

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 Submission at the end of Week 5	25
LA2	Lab activities, attendance, journal	Lab Course Faculty	During Week 5 to Week 8 Submission at the end of Week 9	25
LA3	Lab activities, attendance, journal	Lab Course Faculty	During Week 10 to Week 14 Submission at the end of Week 14	25
Lab ESE	Lab Performance and related documentation	Lab Course faculty	During Week 15 to Week 18 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:

1. Students should maintain a project log book containing weekly progress of the project
2. At the end of the semester project group should achieve all the proposed objectives of the problem statement.
3. The work should be completed in all aspects of design, implementation and testing.
4. Project report should be prepared and submitted in soft and hard form along with all the code and datasets.
5. Group should demonstrate the work with various test cases and results obtained and explain future scope.
6. The group should participate in technical symposiums, paper presentations to demonstrate their work and findings in technical community.

EVEN Semester

Professional Elective (Theory) Courses

Title of the Course: Soft Computing				
Course code: 4CS331	L	T	P	Cr
	3	0	0	3

Desirable requirements:

Textbooks:

S. Rajasekaran, G.A.VijayalakshmiPai “*Neural Networks, Fuzzy Logic and Genetic Algorithms*”, , 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*”

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 analyze learning problems using soft computing.
3. Imbibe capability for innovation in soft computing.
4. Understand hybrid applications of ANN, Fuzzy and GA

Course Learning Outcomes:

CO	After the completion of the course the student should be able to	Bloom’s Cognitive	
		level	Descriptor
CO1	interpret soft computing schemes using knowledge of discrete mathematics, data structures, theory of computer science and computer architectures.	2	Understanding
CO2	demonstrate machine learning processes.	3	Applying
CO3	compare and analyze soft computing schemes.	4	Analyzing
CO4	design schemes using soft computing	6	Creating
CO5	evaluate various schemes of soft computing	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	PO11	PO12	PSO1	PSO2
CO1	2													
CO2			3										2	
CO3		3		2										
CO4			3										2	
CO5				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 the last three modules) covered after MSE.

Course Contents:

Module 1: Module 1 Fundamentals of Neural Networks	5 Hrs.
Basics: Human Brain, Model of Artificial Neuron, Neural Network Architectures, Characteristics of Neural Networks, Learning Methods; McCulloch-Pitts Model; Optimization Problems.	
Module 2: Back propagation Networks (BPN)	9 Hrs.
BPN Architecture, Back propagation learning, applications: Parity Problem, Encoder Decoder, NETtalk and DEC-talk, Character Recognition, Learning Time Sequences, Cognitron; CNN, RCNN, Softmax and one application of each.	

Module 3: Unsupervised Learning	4 Hrs.
Introductions, ARTI Architecture, ART1 Algorithm, Kohonen's Algorithm, Applications of ART1	
Module 4: Fuzzy Systems	6 Hrs.
Crisp logic; Predicate Logic; Fuzzy logic: Fuzzy Quantifiers, Fuzzy Inference; Fuzzy Rule Based System; Defuzzification Methods, Application	
Module 5: Genetic Algorithm	9 Hrs.
Fundamentals: Biological background, Creation of Offsprings, Working Principle, Encoding, Reproduction ; Mathematical Foundations; Data Structure: Mutation, Crossover, Selection; Applications	
Module 6: Hybrid Systems	6 Hrs.
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	
Module wise Measurable Students Learning Outcomes :	
After the completion of the course the student should be able to:	
Module 1: Understand fundamentals of neural networks / models..	
Module 2: Use back propagation network for pattern recognition.	
Module 3: Use unsupervised network for pattern clustering.	
Module 4: Apply fuzzy logic for control and decision making applications.	
Module 5: Use Genetic algorithms for soft computing.	
Module 6: Understand and Compare hybrid systems for efficient soft computing applications.	

Title of the Course: Computer Vision Course code: 4CS332	L	T	P	Cr
	3	0	0	3

Desirable requirements : Digital Image Processing

Textbooks:

1. Richard Szeliski ,Computer Vision: Algorithms and Applications, Springer , September 3, 2010.
2. D. A. Forsyth, J. Ponce ,Computer Vision: A Modern Approach, Pearson Education, 2003.
3. Sonka, Hlavac, Boyle, Digital Image Processing and Computer Vision, Cengage Learning (2008)

References:

1. Richard Hartley and Andrew Zisserman, Multiple View Geometry in Computer Vision, Second Edition, Cambridge University Press, March 2004.
2. K. Fukunaga ; Introduction to Statistical Pattern Recognition, Second Edition, Academic Press, Morgan Kaufmann, 1990.
3. R.C. Gonzalez and R.E. Woods, Digital Image Processing, Addison- Wesley, 1992.

Course Objectives :

1. To illustrate fundamentals of Computer Vision.
2. To write and apply computer vision concepts.
3. To study and compare various algorithms of computer vision.
4. To design scheme of computer vision.

Course Learning Outcomes:

CO	After the completion of the course the student should be able to	Bloom's Cognitive	
		level	Descriptor
CO1	Illustrate fundamentals of computer vision.	3	Applying
CO2	Compare a different algorithms of computer Vision.	4	Analyzing
CO3	Measure performance of different computer vision algorithm.	5	Evaluate
CO4	Design a scheme of computer vision to solve real life problem.	6	Creating

CO-PO Mapping :

PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO11	PO12	PSO1	PSO2
CO1	3												3	
CO2		3											3	
CO3		2											3	
CO4			3										3	

1: Low, 2: Medium, 3: High

Assessments :

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% weight age for course content (normally last three modules) covered after MSE.

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.

Course Contents:

Module 1 Introduction	Hrs.
What is computer vision? A brief history, Structure from motion, Triangulation, Two-frame structure from motion, Factorization, Bundle adjustment, Constrained structure and motion, Dense motion estimation.	8
Module 2 Image stitching	
Motion models, Global alignment, Compositing.	6
Module 3 Computational photography	
Photometric calibration, High dynamic range imaging, Super-resolution and blur removal Image matting and compositing, Texture analysis and synthesis.	7
Module 4 Stereo correspondence	
Epipolar geometry, Sparse correspondence, Dense correspondence, Local methods, Global optimization, Multi-view stereo, 3D reconstruction.	6
Module 5 Image-based rendering	
View interpolation, Layered depth images, Light fields and Lumigraphs, Environment mattes, Video-based rendering.	7
Module 6 Recognition	
Object detection, Face recognition, Instance recognition, Category recognition, Context and scene understanding, Recognition databases and test sets	5

Module wise Measurable Students Learning Outcomes :

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

Module 1:

Describe the fundamental concepts of computer vision and its applications.

Module 2:

Explain Image stitching.

Module 3:

Understand texture analysis and synthesis.

Module 4:

Explain 3D reconstruction of images.

Module 5:

Describe different Image based rendering algorithm.

Module 6:

Implementation of different Recognition algorithm.

Title of the Course: Advanced Computer Network Course code: 4CS333	L	T	P	Cr
	3	0	0	3

Pre-Requisite Courses: Computer Network and Data Communication

Textbooks:

“*Mobile Computing*” Asoke K Telukder, Roopa R Yavagal, TMH 2

References:

1. “*Mobile Communications*” Jochen Schiller, Pearson.
2. “*Wireless Communications and Networks 3G and beyond*” ITI Saha Misra, TMH.
3. “*Principle of wireless Networks*” by Kaveh Pahlavan and Prashant Krishnamurthy, Pearson 2002.

Course Objectives :

To study the evolving wireless technologies and standards

To understand the architectures of various access technologies such as 3G, 4G, WiFi etc.

To understand various protocols and services provided by next generation networks.

Course Learning Outcomes:

CO	After the completion of the course the student should be able to	Bloom’s Cognitive	
		level	Descriptor
CO1	interpret the voice and data communication through various networks	2	Understanding
CO2	Apply knowledge of TCP/IP extensions for mobile and wireless networking.	3	Apply
CO3	Analyze security, mobility, scalability, and their unique characteristics in wireless networks.	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	PO11	PO12	PSO1	PSO2
CO1		1												
CO2		2										1	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: Basic history of Mobile Computing	Hrs.
Architecture for mobile computing, Three tier architecture, design considerations for mobile computing, mobile computing through internet, Wireless network architecture, Applications, Security, Concerns and Standards, Benefits, Future. Evolution of mobile computing.	6
Module 2: Overview of Wireless n/w. and Technologies-I	Hrs.
Introduction, Different generations. Introduction to 1G, 2G, 3G and 4G, Bluetooth, Radio frequency identification(Rfid),Wireless Broadband, Mobile IP: Introduction, Advertisement, Registration, TCP connections, two level addressing, abstract mobility management model, performance issue, routing in mobile host, Adhoc networks, Mobile transport layer: Indirect TCP, Snooping TCP, Mobile TCP, Time out freezing, Selective retransmission, transaction oriented TCP.	7
Module 3 Overview of Wireless n/w. and Technologies-II	Hrs.
Wireless network topologies, Cell fundamentals and topologies, Global system for mobile communication, Global system for mobile communication (GSM), Short message services, Security in wireless networks.	7
Module 4: General packet radio service (GPRS)	Hrs.
GPRS and packet data network, GPRS network architecture, GPRS network operation, data services in GPRS, Applications of GPRS, Billing and charging in GPRS.	6
Module 5: Infrastructure and ad-hoc network	Hrs.
System Architecture, Protocol Architecture, Medium Access Control layer, MAC Management, Wireless LAN advantages, IEEE 802.11a, 802.11b standards ,Wireless LAN architecture, Mobility in Wireless LAN, Deploying Wireless LAN, Mobile ad hoc networks and sensor networks, wireless LAN security.	6
Module 6: Wireless Application Protocol (WAP)	Hrs.
WAP, MMS, GPRS application CDMA and 3G Spread-spectrum Technology, FHSS, DSSS, CDMA versus GSM, Wireless data, third generation networks, applications in 3G Wireless LAN, WiFi v/s 3G Voice over Internet protocol and convergence, Voice over IP,H.323 framework for voice over IP, SIP, Real time protocols, voice over IP applications, IMS, Mobile VoIP, Security issues in mobile Information security, security techniques and algorithms, security framework for mobile environment.	8
<p>Module wise Measurable Students Learning Outcomes : After the completion of the course the student should be able to:</p> <p>Module 1 :</p> <ul style="list-style-type: none"> • understand the concepts of Mobile Computing <p>Module 2 :</p> <ul style="list-style-type: none"> • discuss the architectures of various access technologies such as 3G, 4G, WiFi etc. <p>Module 3 :</p> <ul style="list-style-type: none"> • understand the wireless network technologies and security issues <p>Module 4 :</p> <ul style="list-style-type: none"> • understand the basic principles and architecture of GPRS <p>Module 5 :</p> <ul style="list-style-type: none"> • discuss the system architecture and mobility in wireless networks. <p>Module6 :</p> <ul style="list-style-type: none"> • getting familiar with Wireless Application Protocols 	

Title of the Course: Remote Sensing & Geographic Information System Course code: 4CS334	L	T	P	Cr
	3	-	-	3

Pre-Requisite Courses: Fundamentals of Image processing

Textbooks:

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

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 Learning Outcomes:

CO	After the completion of the course the student should be able to	Bloom’s Cognitive	
		level	Descriptor
CO1	Explain fundamental concepts of RS and GIS	2	Understanding
CO2	Interpret and Apply various satellite sensor data and data products	3	Applying
CO3	Demonstrate GIS data and GIS database management system	3	Applying
CO4	Compare and Analyze RS and GIS data using modern tools and techniques	4	Analyzing
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.	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	
CO3	3												2	
CO4		2			3								3	3
CO5			2		2								3	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	Hrs.
Concepts and Foundation of Remote Sensing 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.	7
Module 2	Hrs.
Sensors, Platforms and Satellite Data Products Broad Classifications of Sensors and Platform, Earth Observation Satellite and Sensors, Data Reception, Transmission and Processing, Remote Sensing Data and Data Products	6
Module 3	Hrs.
Satellite Image Interpretation and Processing Interpretation Procedure and Elements, Interpretation strategies and keys, Digital Image processing and Image Analysis steps, Image Rectification and Restoration, Image Enhancement, Image Transformation, Image Classification and Analysis.	7
Module 4	Hrs.
GIS – An Overview Introduction, Geographical concepts and Terminology, Difference between Image Processing system and GIS, Various GIS packages and their salient features, Essentials components of GIS, Utility of GIS, Applications of GIS	5
Module 5	Hrs.
GIS Data Introduction, GIS Data types and Data Representation, Data Acquisition, Georeferencing of GIS Data, Raster and Vector data, Raster to Vector conversion, Remote Sensing Data in GIS, GIS Database and Database Management System	8
Module 6	Hrs.
Spatial Data Analysis Measurements in GIS-Lengths, Perimeters, and Areas, Queries, Reclassification, Buffering and Neighborhood Functions, Map Overlay, Spatial Interpolation, Analysis of Surfaces, Network Analysis.	6

Module wise Measurable Students Learning Outcomes :

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

Module 1: Understand Fundamentals of RS.

Module 2: Classify various Earth Observation Satellites and Examine their characteristics.

Module 3: Analyze satellite images through Digital Image Processing

Module 4: Understand Fundamentals of GIS.

Module 5: Understand GIS data types and analyze GIS data.

Module 6: Relate different measures of GIS and Design solutions to various problems.

Title of the Course: Deep Learning Course Code: 4CS335	L	T	P	Cr
	3	-	-	3

Desirable requirements: Working knowledge of Linear Algebra, Statistics and Probability Theory

Textbooks:

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

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

Course Learning Outcomes:

CO	After the completion of the course the student should be able to	Bloom’s Cognitive	
		level	Descriptor
CO1	Illustrate fundamentals of deep learning using foundation of mathematics terminology	2	Understanding
CO2	Compare various deep learning models by hyper tuning various parameters	4	Analyzing
CO3	Demonstrate various case studies of deep learning.	3	Applying
CO4	Design and deploy deep learning models on various frameworks and platform.	6	Creating

CO-PO Mapping :

PO and PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2													
CO2		2		1										
CO3			2											1
CO4			3		1									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 to Deep Learning	7 Hrs.
Neural network fundamentals: General Introduction to Deep Learning, Perceptron algorithm, Back propagation and Multi-layer Networks. Image fundamentals: Pixels, Image coordinate, scaling and aspect ratios	
Module 2: Parameterized Learning and Optimization Methods	6 Hrs.
Parameterized Learning: Introduction to linear classification, Four components of parameterized learning, role of loss function. Optimization Methods: Optimization Methods: Gradient descent, stochastic gradient descent (SGD) and extensions to SGD, regularization	
Module 3: Convolutional Neural Networks (CNN)	7 Hrs.
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. CNN Building blocks: Layer Types, Convolutional Layers, Activation Layers , Pooling Layers , Fully-connected Layers , Batch Normalization , Dropout, ShallowNET, LeNet, MiniVGGNET	
Module 4: Deep learning based object detection	6 Hrs.
Fundamentals of Object detection, Family of R-CNN, Single shot detectors (SSD), You only look once (YOLO)	
Module 5: Sequence Models	7 Hrs.
Recurrent Neural Networks, Vanishing gradients, Gated Recurrent Units (GRU), Long-short-term-memories (LSTMs)	
Module 6: Generative Models	6 Hrs.
Autoencoders, Variational Autoencoders, Generative Adversarial Networks	

Module wise Measurable Students Learning Outcomes :

Students will be able

Module 1: To understand fundamentals of deep learning

Module 2: Identify various methods of Fine tuning of optimization parameter

Module 3: Design CNN model for different application

Module 4: Understand object detection using CNN model and to analyze performance.

Module 5: Compare various sequence model architectures.

Module 6: Demonstrate generative model on a simple Dataset

EVEN Semester

Professional Elective (Lab) Courses

Title of the Course: Advanced Web and Mobile Application Development Laboratory Course code: 4CS381	L	T	P	Cr
	0	0	4	2
Desirable Requirement: Programming Lab 3				
Textbooks:				
<ol style="list-style-type: none"> 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, ISBN-13: 978-1951442156 				
References:				
<ol style="list-style-type: none"> 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”, Createspace Independent Publishing Platform, 5th Edition, 2018, ISBN-13: 978-1985170285 				
Online References:				
<ol style="list-style-type: none"> 1. www.w3schools.com 2. https://developer.android.com/docs 3. Official framework websites for Documentation/Help 				
Course Objectives:				
Summary:				
<p>Since its invention, World Wide Web (WWW) has impacted every area of human life. It is continuously evolving and new technologies are being added every few months to make it better in terms of ease of development, User Interface (UI) and User Experience (UX), ease of use, and many more to count on. Also, with the development of smartphone technology, people are relying more on the smartphones because of its portable nature, equal amount of processing power as compared to the computers, ease of use, support from third party apps, etc.</p> <p>This course introduces students to the state-of-the-art front-end, back-end web and mobile app development frameworks/libraries and tools. Students will learn these technologies and tools, debug and test their projects done with these technologies and tools and can deploy/publish their projects/app over the internet.</p>				
<ol style="list-style-type: none"> 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 Learning Outcomes:

CO	After the completion of the course the student should be able to	Bloom's Cognitive	
		level	Descriptor
CO1	summarize the concepts of various state-of-the-art front-end, back-end web and mobile app development technologies & frameworks.	2	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.	3	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.	4	Analyzing
CO4	select appropriate front-end, back-end web and mobile app development technologies, frameworks, tools and their components to solve real-world problems.	5	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.	6	Creating

CO-PO Mapping:

PO and PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
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

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 Submission at the end of Week 5	25
LA2	Lab activities, attendance, journal	Lab Course Faculty	During Week 5 to Week 8 Submission at the end of Week 9	25
LA3	Lab activities, attendance, journal	Lab Course Faculty	During Week 10 to Week 14 Submission at the end of Week 14	25

Lab ESE	Lab Performance and related documentation	Lab Course faculty	During Week 15 to Week 18 Submission at the end of Week 18	25
<p>Week 1 indicates starting week of Semester.</p> <p>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.</p>				
Course Contents:				
Module 1: Web Application Framework/Library – Part 1				Hrs.
<p>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.</p> <p>Experiments:</p> <ol style="list-style-type: none"> 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. 				10
Module 2: Web Application Framework/Library – Part 2				Hrs.
<p>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.</p> <p>Experiments:</p> <ol style="list-style-type: none"> 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. 				10
Module 3: Server-side Development Framework/Library – Part 1				Hrs.
<p>State-of-the-art server-side Technology: Ruby on Rails, Flask or other state-of-the-art back-end development framework/library.</p> <p>Experiments:</p> <ol style="list-style-type: none"> 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. 				10
Module 4: Server-side Development Framework/Library – Part 2				Hrs.
<p>State-of-the-art server-side Technology: Django or another state-of-the-art framework/library.</p> <p>Experiments:</p> <ol style="list-style-type: none"> 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. 				8

<ul style="list-style-type: none"> 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	Hrs.
<p>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.</p> <p>Experiments:</p> <ul style="list-style-type: none"> 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. 	10
Module 6: Hosting Web Applications	Hrs.
<p>Building web application and Hosting web application.</p> <p>Experiments:</p> <ul style="list-style-type: none"> 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. 	4

Title of the Course: Software Engineering Tools Laboratory Course Code: 4CS382	L	T	P	Cr
	0	0	4	2

Desirable Requirements: Software Engineering SDLC, Project Management, Agile Methodology

Textbooks:

1. Dr.K.V.K.K.Prasad, “Software Testing Tools “
2. Desikan, Ramesh, “Software Testing: principles and Practices”, Pearson Education, ISBN

References:

1. Nina Godbole, “Software Quality Assurance: Principles And Practice”, Alpha Science International, Ltd (August 1, 2004)

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.

Course Learning Outcomes:

CO	After the completion of the course the student should be able to	Bloom’s Cognitive	
		level	Descriptor
CO1	be familiar with open source software development tools currently used in the industry.	2	Understanding
CO2	utilize open source software for developing a variety of software applications, particularly Web applications	3	Applying
CO3	get acquainted with use of software tools to achieve quality and industry readiness	6	Creating

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	PO11	PO12	PSO1	PSO2
CO1	2	2											1	
CO2					2									
CO3				2		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 Submission at the end of Week 5	25
LA2	Lab activities, attendance, journal	Lab Course Faculty	During Week 5 to Week 8 Submission at the end of Week 9	25
LA3	Lab activities, attendance, journal	Lab Course Faculty	During Week 10 to Week 14 Submission at the end of Week 14	25
Lab ESE	Lab Performance and related documentation	Lab Course faculty	During Week 15 to Week 18 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	Hrs.
Introduction: FOSS, Open source software tools, Benefits, Software quality assurance.	
Module 2	Hrs.
Software Development Frameworks: Eclipse and Android SDK, Node.Js, DotNet, Ruby on Rails	
Module 3	Hrs.
Project Management Tools: Github- Issues, Labels, Mile stones, Wiki pages, Project board.	
Module 4	Hrs.
Configuration Management Tools: Documentation tools, Version control VSS, , Access control, Distributed source code control (CVS, SVN)	
Module 5	Hrs.
Software Testing tools: Need for Automated Testing tools, the V model for testing, Functional, Regression, Performance, Test Management, Source Code Testing and How to select testing tools.	
Module 6	Hrs.
Study of testing tools: Win Runner, Load Runner, Selenium, Test director ,QTP, Rational Robot, Clearcase etc.	

EVEN Semester

Open Electives Courses

Title of the Course: Artificial Intelligence and Machine Learning Course Code: 4OE378	L	T	P	Cr
	3	-	-	3

Desirable requirement: Introductory Programming knowledge, Probability and statistics

Textbooks:

1. Elaine Rich and Kelvin Knight ,Nair , “Artificial Intelligence,” McGraw Hill Publication
2. Janakiraman et al., “Foundations of Artificial Intelligence and Expert Systems”, Macmilan India
3. Tom M. Mitchell, Machine Learning, McGraw-Hill

References:

1. NPTEL course on Introduction to AI
2. NPTEL course on Introduction to ML

Course Objectives :

1. Introduce and apply Principles of Artificial Intelligence
2. Introduce and apply Principles of Machine Learning

Course Learning Outcomes:

CO	After the completion of the course the student should be able to	Bloom’s Cognitive	
		Level	Descriptor
CO1	Illustrate AI and ML Problems and its simple solutions	2	Applying
CO2	Compare simple solutions for AI and ML problems	3	Analyzing
CO3	Classify various AI and ML problem solving schemes	4	Evaluating

CO-PO/PSO Mapping :

PO/PSO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO11	PO12	PSO1	PSO2
CO1	3												1	
CO2		3											1	
CO3		3											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 to AI and Problem Solving	Hrs.
Introduction, History, Application, Approaches, Problem solving by searching, Constraint satisfaction problems.	06
Module 2 Knowledge Representation, Logic and Reasoning	Hrs.

Propositional Logic, Inference rules, First Order Logic, Rule based systems, Reasoning with uncertainty, Fuzzy reasoning, Bayes networks	07
Module 3 Expert Systems	Hrs.
ES Characteristics, Architecture, Rule based ES, Rule Induction, Introduction to Natural Language Processing.	06
Module 4 Introduction to Machine Learning	Hrs.
Introduction to Machine Learning, Concepts of Supervised and Unsupervised Learning, Linear and Multivariate Regression, Dimensionality Reduction	07
Module 5 Bayesian Learning and Decision Trees	Hrs.
Equations, Description, Maximum Likelihood estimate, Decision Trees, examples	06
Module 6 Module 4 : Evaluation Measures and Hypothesis Testing 6 Hrs.	Hrs.
Evaluation Measures, ROC curve, Case Study	06
Module wise Measurable Students Learning Outcomes : After the completion of the course the student should be able to: Module 1: Understand and describe AI problems and its solutions in simple form Module 2: Describe rule based systems Module 3: Describe a scheme in ES Module 2: Describe rule based systems Module 3: Describe a scheme in ES Module 4: Understand and describe Machine learning Module 5: Describe and apply Bayesian and decision tree Module 6: Compare various ML schemes using performance measures	

EVEN Semester

Minor Specialization Courses

Title of the Course: Computer Networks Course code: 1CSM04	L	T	P	Cr
	3	0	0	3

Pre-Requisite Courses:

Textbooks:

1. Behrouz A. Forouzan, “Data communication and Networking”, Tata McGraw-Hill, 4th/5th Edition, 2017.

References:

1. William Stallings, “Data and Computer Communications”, Prentice Hall(PHI) , 8th /9th Edition, 2010/2011
2. 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 networking which will give students insight about how the computer networks actually work in real time. Objectives are further divided as:

1. Elaborate various terminologies related to computer networking
2. Give information about networking components
3. Make students aware about various concepts and networking model behind day to day networking
4. Explain protocols used in real time applications

Course Learning Outcomes:

CO	After the completion of the course the student should be able to	Bloom’s Cognitive	
		level	Descriptor
CO1	Describe fundamentals related to Computer networking	2	Understanding
CO2	Interpret various techniques behind networking	3	Apply
CO3	Distinguish among networking concepts and protocols	4	Analyze

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	PO11	PO12	PSO1	PSO2
CO1	1													
CO2		2												
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 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	5 Hrs.
A Basic Model of Communication, Networks, Networking Concepts and Terminology: Analog and Digital Data Transmission, Transmission Impairments, Channel Capacity, Data and Signals.	
Module 2: Transmission Media and Networking Devices	6 Hrs.
Guided Transmission Media, Wireless Transmission, Types of electronics communication, Electromagnetic spectrum, Networking Devices	
Module 3 : Networking Basics	6 Hrs.
Evolution of network, Introduction to Computer Networks, Physical & Logical Topology, Introduction to types of network, internetworking, Intranet, Internet	
Module 4 : Network Models and Routing	6 Hrs.
The OSI Model, Layers of OSI Model, TCP/IP Protocol Suit, Routing in Internet, Switching.	
Module 5 :Addressing	8 Hrs.
Physical Addressing, Logical Addressing: IPv4 addresses , IPv6 addresses, internetworking, Address Mapping Protocols	
Module 6 : Application Layer Protocols	8 Hrs.
The application Layer, Working of EMAIL, File Transfer Protocol (FTP), WWW, HTTP, Domain Name Space (DNS), SNMP	

Module wise Measurable Students Learning Outcomes :

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

Module 1:

- Understand basic networking terminologies

Module 2:

- Differentiate types of transmission and networking devices

Module 3:

- Understand Idea behind computer networking and different types of network

Module 4:

- Articulate the knowledge of networking models and routing in Internet

Module 5:

- Apprehend the concept of addressing and address mapping protocol

Module 6:

- Learn application layer protocols used in real time application

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Walchand College of Engineering, Sangli

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Course Information

Programme	B.Tech. (Computer Science and Engineering)
Class, Semester	Final Year B. Tech., Sem VII
Course Code	
Course Name	Cryptography and Network Security
Desired Requisites:	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	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,

CO1	Apply the number theory concepts to different encryption and decryption techniques to solve problems related to confidentiality and authentication.	Apply
CO2	Analyze security of network protocols and systems	Analyze
CO3	Justify various methods of authentication and access control for application of technologies to various sections of industry and society.	Evaluate
CO4	Identify and classify security threats and develop a security model to prevent, detect and recover from attack	Create

Module	Module Contents	Hours
I	INTRODUCTION 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 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 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 Properties of hash functions, MD2, MD5 and SHA-1, keyed hash functions, attacks on hash functions, Identity and Access Management (IAM), Digital signature–	6

	Entity Authentication: Passwords, challenge-response algorithms, zero-knowledge protocols, Authentication applications – Kerberos, X.509.	
V	NETWORK SECURITY 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 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

Text Books

1	William Stallings, “ <i>Cryptography and Network Security: Principles and Practice</i> ”, Prentice Hall of India.
2	Behrouz A. Forouzan “ <i>Cryptography And Network Security</i> ”. 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, “ <i>Introduction to Cryptography</i> ”, Springer.

Useful Links

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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	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 1,2,3; 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)

Bloom's Taxonomy Level	T1	T2	ESE	Total
1 Remember				
2 Understand				
3 Apply	10		20	30
4 Analyze	5	10	20	35
5 Evaluate		10	10	20
6 Create	5		10	15
Total	20	20	60	100

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Course Information

Programme	B.Tech. (Computer Science and Engineering)
Class, Semester	Final Year B. Tech., Sem VII
Course Code	
Course Name	Cryptography and Network Security Lab
Desired Requisites:	Computer Networking

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 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 |
| 4 | |

Course Outcomes (CO) with Bloom's Taxonomy Level

At the end of the course, the students will be able to,

CO1	Develop code for classical Encryption Techniques to solve the real life problems	Apply
CO2	Analyze the network security system using open source tools	Analyze
CO3	Evaluate the securities of different security protocols	Evaluate
CO4	Build cryptosystems by applying symmetric and public key encryption algorithms	Create

List of Experiments / Lab Activities

List of Experiments:

- Perform encryption, decryption using the following substitution techniques
 - Ceaser cipher,
 - playfair cipher
 - Hill Cipher
 - Vigenere cipher
- Perform encryption and decryption using following transposition techniques
 - Rail fence
 - row and Column Transformation
- Implementation of Euclidean and Extended Euclidean Algorithm
- Implementation of Chinese Remainder Theorem (CRT)
- Apply DES algorithm for practical applications
- Apply AES algorithm for practical applications
- Implementation of RSA Algorithm
- Implement the Diffie-Hellman Key Exchange algorithm for a given problem
- Calculate the message digest of a text using the SHA-1 algorithm
- Implement the SIGNATURE SCHEME – Digital Signature Standard
- Demonstration of SSL using Wireshark
- 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.

Text Books	
1	William Stallings, “ <i>Cryptography and Network Security: Principles and Practice</i> ”, Prentice Hall of India.
2	Behrouz A. Forouzan “ <i>Cryptography And Network Security</i> ”. 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	
4	
Useful Links	
1	

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	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
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	10	5	10	25
Analyze	10	5	10	25
Evaluate		10	10	20
Create	10	10	10	30
Total Marks	30	30	40	100

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Course Information

Programme	B.Tech. (Computer science and engineering)
Class, Semester	Final Year B. Tech., Sem VII
Course Code	
Course Name	Project-1 and Seminar
Desired Requisites:	Nil

Teaching Scheme		Examination Scheme (Marks)			
Lecture	-	LA1	LA2	ESE	Total
Tutorial	-	30	30	40	100
Practical	6 Hrs/week				
Interaction	-	Credits: 3			

Course Objectives

1	To understand project identification process and carryout literature survey for real world problem
2	To use latest design, development tools and technologies.
3	To undergo project management techniques.
4	To acquire ability to map technical skills to real life applications through modeling.

Course Outcomes (CO) with Bloom's Taxonomy Level

CO1	demonstrate the state-of-art technological trends through seminar.	Understanding
CO2	work in teams and participate in group activity of software development.	Applying
CO3	build and demonstrate the prototype / miniature model.	Creating

List of Experiments / Lab Activities

List of Experiments:

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.

Text Books

1	Nil
2	
3	
4	

References

1	Nil
2	
3	
4	

Useful Links

1	Nil
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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	--	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
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	20	10		30
Apply	10	20	20	50
Analyze				
Evaluate				
Create			20	20
Total Marks	30	30	40	100

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Course Information

Programme	B.Tech. (Computer Science and Engineering)
Class, Semester	Final Year B. Tech., Sem VII
Course Code	
Course Name	High Performance Computing
Desired Requisites:	Data structures, Basic Programming knowledge

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 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,

CO1	Describe different parallel paradigms, inter connection networks, and tools for parallel programming.	Understand
CO2	Demonstrate design methodology and performance measurement of parallel algorithms on various parallel platforms.	Apply
CO3	Analyze a given problem for possibilities of parallel computations	Analyze

Module	Module Contents	Hours
I	Introduction What is parallel computing? The scope of parallel computing? Issues in parallel computing. Taxonomy of parallel architecture, Dynamic interconnection networks, static interconnection networks, Routing mechanism for static network. Communication cost in static interconnection network.	7
II	Parallel programming models and paradigms 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 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.	6
IV	parallel programming libraries 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	6
V	Parallel programming using accelerators Introduction of CUDA/OpenCL, Chapel, etc. Basics of GPGPU, CUDA Programming model, CUDA memory type, CUDA and/or	7

	OpenCL for GPGPU hardware, case study.	
VI	Algorithms Dense matrix algorithms, sorting, graph algorithms.	7
Text Books		
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	
References		
1	“Parallel Programming in C with MPI and OpenMP”, Michael J. Quinn, McGraw-Hill, 2004.	
Useful Links		
1	High Performance Computing, Charles Severance, 1998. http://cnx.org/content/col11136/latest/	
2	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	
3	Designing and Building Parallel Programs, Ian Foster, 1995. http://www.mcs.anl.gov/~itf/dbpp/	

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	1	
CO2		3											3	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.

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	5	20
2	Understand	10	10	5	25
3	Apply		5	25	30
4	Analyze		25		25
5	Evaluate				
6	Create				
	Total	20	20	60	100

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Course Information

Programme	B.Tech. (Computer Science & Engineering)
Class, Semester	Final Year B. Tech., Sem VII
Course Code	
Course Name	Data Mining
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	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,

CO1	apply the data pre-processing and data mining algorithms to solve real world problems	Apply
CO2	analyze a complex data mining problem and different data mining algorithms to identify solutions.	Analyze
CO3	measure the performance of different data mining algorithms/tools, evaluate and recommend the optimal solution.	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.	Create

Module	Module Contents	Hours
I	Introduction Why and what is Data Mining? What Kinds of Data Can Be Mined? What Kinds of Patterns Can Be Mined? Which Technologies Are Used? Which Kinds of Applications Are Targeted? Major Issues in Data Mining.	5
II	About Data and its pre-processing 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 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 Basic concepts, measuring data similarity and dissimilarity, partitioning methods, Hierarchical Methods, Density-Based methods, Evaluation of Clustering	6
V	Association Rule Mining Basic concepts, Frequent itemset mining methods, interesting patterns and its evaluation methods, Pattern Exploration and Application.	6
VI	Web Mining Introduction, web content mining, web structure mining, web usage mining	7

Text Books

1	Jiawei Han , Micheline Kamber and Jian Pei , “ <i>Data Mining - Concepts and Techniques</i> ” , Third Edition, Morgan Kaufmann, 2012, ISBN 978-0-12-381479-1
2	Dunham, Margaret H , “ <i>Data Mining: Introductory and Advanced Topics</i> ”, 1 st Edition , PHI/Pearson, 2006 , ISBN 978-81-7758-785-2

References

1	Sumathi, S., Sivanandam, S.N. , “ <i>Introduction to Data Mining and its Applications</i> ”, Springer , 2006 , ISBN 978-3-540-34351-6
2	P. Tan, M. Steinbach and V. Kumar, “ <i>Introduction to Data Mining</i> ”, 2 nd Edition, Addison Wesley, 2019,
3	Related papers from various IEEE Transactions , Int. Journals / Conferences.
4	

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	3
CO1	2												2		
CO2		3												2	
CO3				3									3		
CO4			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				
3 Apply	7	5	25	37
4 Analyze	6	5	13	24
5 Evaluate	3	5	10	18
6 Create	4	5	12	21
Total	20	20	60	100

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Course Information

Programme	B.Tech. (Computer Science and Engineering)
Class, Semester	Final Year B. Tech., Sem VII
Course Code	
Course Name	High Performance Computing Lab
Desired Requisites:	Data structures, Basic Programming knowledge

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 provide basics of parallel architectures |
| 2 | To provide basics of parallel algorithm design and analysis |
| 3 | To provide basics of parallel programming platforms |

Course Outcomes (CO) with Bloom's Taxonomy Level

At the end of the course, the students will be able to,

CO1	Comparison of different parallel architectures and performance evaluation	Understand
CO2	To measure performance of model using different metrics	Apply
CO3	To design a parallelization strategy for computing patterns on different hardware and using different parallel computing languages.	Create

List of Experiments / Lab Activities

List of Experiments:

- 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.

Text Books	
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	3
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.

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	15		5	20
Understand	15	5	5	25
Apply		15	15	30
Analyze		10	15	25
Evaluate				
Create				
Total Marks	30	30	40	100

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Course Information

Programme	B.Tech. (Computer Science & Engineering)
Class, Semester	Final Year B. Tech., Sem VII
Course Code	
Course Name	Data Mining Lab
Desired Requisites:	Database Engineering

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	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,

CO1	interpret the data mining process and handle important issues around data cleaning, pre-processing and integration.	Apply
CO2	analyse the real world problems using different data mining algorithms.	Analyze
CO3	measure the performance of different data mining algorithms / tools.	Evaluate
CO4	design and build the data mining system for solving any complex problem.	Create

List of Experiments / Lab Activities

List of Experiments:

- For iris and breast cancer data set
 - Calculate the mean, median, and standard deviation of conditional attributes.
 - Draw histogram
 - Draw the boxplots for pairs of attributes.
 - Draw a scatter plot and a Quantile-Quantile (q-q) plot based on these two variables.
- For iris and breast cancer data set, perform the
 - Correlation analysis
 - discretization using Binning and Histogram Analysis
- Design and implementation of following classifiers :
 - Regression classifier.
 - Naïve Bayesian Classifier.
 - k-NN classifier (Take k = 1,3,5,7)
 - Three layer Artificial Neural Network (ANN) classifier (use back propagation)
- Design and implementation of following clustering algorithms :
 - Hierarchical clustering - AGNES & DIANA. Plot Dendrogram.
 - k-Means
 - k-Medoids (PAM)
 - 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 output should 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 in the 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 Data Miner etc.
8. Mini-project : Group (2/3) of students should search any research journal / literature on data mining and 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 CASE tools.
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.
4. Follow the submission guidelines.

Text Books

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.
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	3
CO1	3												2		
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
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	5	5	7	17
Analyze	5	5	7	17
Evaluate	5	5	6	16
Create	15	15	20	50
Total Marks	30	30	40	100

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AY 2021-22					
Course Information					
Programme		B.Tech. (Computer Science & Engineering)			
Class, Semester		Final Year B. Tech., Sem VII			
Course Code					
Course Name		Software Defined Network			
Desired Requisites:		Computer Network and Data Communication			
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 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,					
CO1	understand OpenFlow, challenges in SDN, and the recent development in SDN				Understanding
CO2	Analyse and apply implementation of SDN through Open Flow Switches, SDN-Controllers.				Analysing, Applying
CO3	Evaluate the pros and cons of applying SDN, API approaches, Hypervisor overlays, and SDN Data Centre				Evaluating
Mod ule	Module Contents				Hours
I	History and Evolution of Software Defined Networking (SDN) 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 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 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 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 Network architecture, NFV Infrastructure, NFV Management and Orchestration (MANO), NFV and SDN				5

VI	Data Centre Networks Packet, Optical and Wireless Architectures, Network Topologies. Use Cases of SDNs: Data Centres, Internet Exchange Points, Backbone Networks, Home Networks, Traffic Engineering.	7
Text Books		
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	3
CO1		2			3							1			
CO2					3							2			
CO3												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	10	15
2	Understand	5	5	15
3	Apply	10	10	25
4	Analyze		5	10
5	Evaluate			
6	Create			
Total		20	20	60
				100

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Course Information

Programme	B.Tech. (Computer Science and Engineering)
Class, Semester	Final Year B. Tech., Sem VII
Course Code	
Course Name	Advanced Machine Learning
Desired Requisites:	Introduction to Machine Learning

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	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
3	Compare generative models, use FID method to assess GAN fidelity and diversity, learn to detect bias in GAN, and implement StyleGAN techniques
4	Use GANs for data augmentation and privacy preservation, survey GANs applications, and examine and build Pix2Pix and CycleGAN for image translation

Course Outcomes (CO) with Bloom's Taxonomy Level

At the end of the course, the students will be able to,

CO1	Explain advanced mathematical concept required for machine learning	Understand
CO2	Understand the intuition behind the fundamental components of GANs	Understand
CO3	Explore and implement multiple GAN architectures	Apply
CO4	Build conditional GANs capable of generating examples from determined categories	Create

Module	Module Contents	Hours
I	Introduction Mathematical Basics, Introduction to Machine Learning, Gradient Descent, Stochastic gradient descent: the workhorse of machine learning, Theory of SGD for convex objectives	8
II	Backpropagation and hyperparameters 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	6
III	Intro to GANs Learn about GANs and their applications, understand the intuition behind the basic components of GANs, and build your very own GAN using PyTorch.	6
IV	Deep Convolutional GAN 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

V	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.	7
VI	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.	7
Text Books		
1	Jacob langr, "GANs in Action: Deep learning with Generative Adversarial Networks" 1st Edition	
2	Deep Learning, Goodfellow et al, MIT Press, 20172.	
3	Pattern Recognition and Machine Learning, Christopher Bishop, Springer, 20093.	
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	3
CO1	3														
CO2					3										
CO3			1		2										
CO4			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	10	10	30
3	Apply	10	5	25	40
4	Analyze				
5	Evaluate				
6	Create		5	25	30
Total		20	20	60	100

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Course Information

Programme	B.Tech. (Computer Science and Engineering)
Class, Semester	Final Year B. Tech., Sem VII
Course Code	
Course Name	Intelligent Systems
Desired Requisites:	Exposure to concepts in discrete structures, probability/statistics and algorithmic analysis

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 concepts of Artificial Intelligence (AI) with emphasis on its use to solve real world problems.
2	To explain the challenges inherent in building “intelligent systems”.
3	To explain core techniques and algorithms.

Course Outcomes (CO) with Bloom’s Taxonomy Level

At the end of the course, the students will be able to,

CO1	discuss the basic concepts of Artificial Intelligence	Understanding
CO2	use basic knowledge representation, problem solving, and learning methods in AI	Applying
CO3	examine the applicability of algorithms in solving particular engineering problems to build intelligent systems.	Analyzing

Module	Module Contents	Hours
I	Module 1 Introduction to Artificial Intelligence Introduction, History, Application, Approaches, Introduction to Agents	4
II	Module 2 Problem Solving Problem solving by searching, Uninformed and informed search, Constraint satisfaction problems	8
III	Module 3 Knowledge Representation and Logic Propositional Logic, Inference rules, First Order Logic, Rule based systems, Semantic nets, Frames	8
IV	Module 4 Planning Introduction, Components of planning, Partial-order-planning, Graph plan, SATPLAN	6
V	Module 5 Reasoning Reasoning with uncertainty, Fuzzy reasoning, Bayes networks, Reasoning in semantic net	6
VI	Module 6 Expert Systems and Machine Learning Introduction, ES Architecture and Phases, ES Characteristics, Rule based ES, Rule Induction and Decision Trees; Natural Language Processing, Case studies: Philips – AI in clinics and hospitals, Schneider Electric – Improving agriculture and farming with AI, Google & TNO – AI for data analysis on traffic safety, Siemens – AI for industry, power grids and rail systems	7

Text Books

1	Stuart Russell and Peter Norvig, “Artificial Intelligence – A Modern Approach”, Prentice-Hall, 3rd edition, 2010
2	Elaine Rich and Kelvin Knight ,Nair , “Artificial Intelligence,” McGraw Hill Publication, 3rd edition,1st July 2017

References	
1	Janakiraman et al., “Foundations of Artificial Intelligence and Expert Systems”, Macmilan India Ltd.
2	Townsend, “Introduction to Turbo prolog”
Useful Links	
1	https://www.youtube.com/watch?v=X_Qt0U66aH0&list=PLwdnzlV3ogoXaceHrrFVZCJkbm_laSHcH
2	https://www.youtube.com/watch?v=XCPZBD9lbVo&list=PLbMVogVj5nJQu5qwm-HmJgjmeGhsErvXD
3	Mod-01 Lec-01 Introduction - YouTube
4	Mod-01 Lec-02 Stages of NLP - YouTube

CO-PO Mapping															
	Programme Outcomes (PO)												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1															
CO2	2												2		
CO3		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	12	30	57
3	Apply	5	4	20	29
4	Analyze		4	10	14
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	Final Year B. Tech., Sem. VII
Course Code	
Course Name	Data Management, Protection and Governance (By Veritas)
Desired Requisites:	

Teaching Scheme		Examination Scheme (Marks)			
Lecture	3Hrs/week	T1	T2	ESE	Total
Tutorial	-	20	20	60	100
Practical	-				
Interaction	-	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

CO1	Illustrate data management world and various types of data threats and approaches to ensure data center security	Understand
CO2	Apply different standards for compliance and governance of data	Apply
CO3	Analyze various types of data threats and approaches to ensure data center security	Analyze
CO4	Discriminate various concepts and technologies for enabling data storage and high availability	Evaluate
CO5	Design data intensive enterprise applications and industry standard solutions in data management	Create

Module	Module Contents	Hours
I	Introduction to data life cycle management (DLM) 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 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, thinprovisioning, 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, Split-brain – problem and solutions o Preparing for DR – firedrill	8

III	Introduction to data protection 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), challenges with new edge technology (cloud, containers)	8
IV	Data Threats and Data center security 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, Design and architecture considerations for security	7
V	Data regulation, compliance and governance 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 tagging (Natural Language Processing)	5
VI	Applications uninterrupted 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

Text Books

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://searchstorage.techtarget.com/definition/data-life-cycle-management
3	https://www.hitechnectar.com/blogs/three-goals-data-lifecycle-management/
4	https://www.bmc.com/blogs/data-lifecycle-management/
5	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	3
CO1		3											2		
CO2	3												3		
CO3	3	2												3	
CO4		3												1	
CO5		3													

The strength of mapping is to be written as 1,2,3; 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	20
3	Apply	5	10	15	30
4	Analyze	5	5	15	25
5	Evaluate		5	10	15
6	Create			10	10
Total		20	20	60	100

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Course Information

Programme	B. Tech. (Computer Science and Engineering)
Class, Semester	Final Year B. Tech., Sem VII
Course Code	
Course Name	OE-3 Cyber Security
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	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

CO1	Understand the concepts of cyber security and data privacy in today's environment.	Understand
CO2	Perform fundamental incident response functions including detecting, responding, and recovering from security incidents.	Apply
CO3	Analyze and resolve security issues in networks and computer systems to secure an IT infrastructure	Analyze
CO5	Evaluate and communicate the human role in security systems with an emphasis on ethics, social engineering vulnerabilities and training.	Evaluate
CO4	Design appropriate security technologies and policies to protect computers and digital information.	Create

Module	Module Contents	Hours
I	Introduction to Cyber Space 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 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 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 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 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 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
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Text Books

1	Nina Godbole and Sunit Belpure, “ <i>Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives</i> ”, Wiley
2	B. B. Gupta, D. P. Agrawal, Haoxiang Wang, “ <i>Computer and Cyber Security: Principles, Algorithm, Applications, and Perspectives</i> ”, CRC Press, ISBN 9780815371335, 2018

References

1	“ <i>Cyber Security Essentials</i> ”, James Graham, Richard Howard and Ryan Otson, CRC Press.
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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	3
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 1,2,3; 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	5	10	25
3 Apply	5	10	15	30
4 Analyze	5	5	15	25
5 Evaluate			10	10
6 Create			10	10
Total	20	20	60	100

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Course Information

Programme	B.Tech. (Computer Science and Engineering)
Class, Semester	Final Year B. Tech., Sem VIII
Course Code	
Course Name	Techno-Socio Outreach
Desired Requisites:	Nil

Teaching Scheme		Examination Scheme (Marks)			
Lecture	-	LA1	LA2	ESE	Total
Tutorial	-	30	30	40	100
Practical	-				
Interaction	1Hr/week	Credits: 1			

Course Objectives

1	To identify real life social problems at local/global level
2	To propose possible solution using technical skills and analyse its impact for the betterment of the society and contribute for the nation building.
3	To encourage students to participate in technical and social activities

Course Outcomes (CO) with Bloom's Taxonomy Level

CO1	Identify and Analyze real world social problem.	Analyse
CO2	Demonstrate the solution individual or in group to techno-socio problem using technical skill towards society and nation building	Create

List of Experiments / Lab Activities

General guidelines:

Open to students. Student can undertake any techno-socio activity as listed below but not limited to it :

1. 50% weightage in each evaluation for technical aspects and 50% for societal importance
2. Each student or group of students may participate in any social activity like "Swachh Bharat Abhiyan",
3. "Blood Donation Camp", or any social activity announced by Govt. / Corporation / Panchayat. Each student or group of students participating in technical events / competition.
4. Awards / recognition received in techno-socio activity
5. Completing the on line courses (on topics beyond syllabus) / certification of any companies / technologies (e.g. IBM / Oracle / CISCO etc.)
6. Developing any innovative gadget / solution / system and transfer in the interest of Nation / Society / Institute (WCE)
7. Published a papers in national / international conferences / journals
8. Coordinating the students clubs / services
9. Organizing techno-socio activity for the students / community in rural areas, backward areas.

Text Books

1	Nil
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References

1	The students may refer/undergo on line courses required to undertake any techno-socio activity.
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Useful Links

1	Nil
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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	2	--	--	--	2	--	--
CO2	--	--	--	--	--	3	3	2	3	--	--	--	3	--	--
CO3	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

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	Relative activity completion certification in SEM III & IV	Lab Course Faculty	During Week 1 to Week 6 Marks Submission at the end of Week 6	30
LA2	Relative activity completion certification in SEM V & VI	Lab Course Faculty	During Week 7 to Week 12 Marks Submission at the end of Week 12	30
Lab ESE	Relative activity completion certification in SEM VII & VIII	Lab Course Faculty	During Week 15 to Week 18 Marks Submission at the end of Week 18	40

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	20	15	20	55
Evaluate				
Create	10	15	20	45
Total Marks	30	30	40	100

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Course Information

Programme	B.Tech. (Computer Science and engineering)
Class, Semester	Final Year B. Tech., Sem VIII
Course Code	
Course Name	Project-2
Desired Requisites:	Nil

Teaching Scheme		Examination Scheme (Marks)			
Lecture	-	LA1	LA2	ESE	Total
Tutorial	-	30	30	40	100
Practical	16 Hrs/week				
Interaction	-	Credits: 8			

Course Objectives

1	To undergo project management techniques
2	To apply project design principles using latest tools and technologies
3	To develop analytical vision and skills to analyse, compare the outcome with other techniques
4	To write and publish deliverable technical artifacts for the project

Course Outcomes (CO) with Bloom's Taxonomy Level

CO1	work in teams and participate in group activity of software development	Apply
CO2	demonstrate different product development phases through appropriate selection of software tool for project implementation.	Evaluate
CO3	develop a software product	Create
CO4	analyse performance of developed product and Write/publish technical artifacts	Analyse

List of Experiments / Lab Activities

List of Experiments:

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.

Text Books

1	Nil
2	
3	
4	

References

1	Nil
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	3
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
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	20	15	10	
Analyze			10	
Evaluate	10	10	10	
Create		05	10	
Total Marks	30	30	40	100

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Course Information

Programme	B.Tech. (Computer Science and Engineering)
Class, Semester	Final Year B. Tech., Sem VIII
Course Code	
Course Name	Computer Forensic
Desired Requisites:	Cyber Security

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 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,

CO1	apply the methods for data recovery, evidence collection and data seizure.	Apply
CO2	analyze a large amount of digital evidence and identify the most significant data.	Analyze
CO3	evaluate the different types of computer forensics technologies	Evaluate
CO4	apply a number of different computer forensic tools to a given scenario.	Apply

Module	Module Contents	Hours
I	Introduction Computer forensics fundamentals, Benefits of forensics, computer crimes, computer forensics evidence and courts, legal concerns and private issues.	6
II	Understanding Computing Investigations Procedure for corporate High-Tech investigations, understanding data recovery workstation and software, conducting investigations.	6
III	Methods of Storing Data 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.	6
IV	Storage Formats and Digital Evidence 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 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 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
Text Books		
1	Warren G. Kruse II and Jay G. Heiser, “ <i>Computer Forensics: Incident Response Essentials</i> ”, Addison Wesley	
2	B Nelson, B, Phillips, A, Enfinger, F, Stuart, C., “ <i>Guide to Computer Forensics and Investigations</i> ”, 2nd ed., Thomson Course Technology	
References		
1	Vacca, J, “ <i>Computer Forensics, Computer Crime Scene Investigation</i> ”, 2nd Ed, Charles River Media, ISBN: 1-58450-38	
Useful Links		
1		

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										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 1,2,3; 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	10	10	20	40
4	Analyze	10	5	15	30
5	Evaluate		5	25	30
6	Create				
Total		20	20	60	100

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Course Information

Programme	B.Tech. (Computer Science and Engineering)
Class, Semester	Final Year B. Tech., Sem VIII
Course Code	
Course Name	Search Engine Design and Optimization
Desired Requisites:	Programming Laboratory – 3

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 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

CO1	describe working of search engines and SEO techniques	Understand
CO2	illustrate various SEO techniques	Apply
CO3	comprehend strengths and weaknesses of SEO techniques and use appropriate SEO technique as per real life scenario	Analyze

Module	Module Contents	Hours
I	Search Engines and SEO Overview 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 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 Keyword Problems and Solutions, Keyword Analysis Tools	6
III	On-page Optimization Techniques The difference – On-page and Off-page optimization, 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 Tag, Doorway Pages, 301 Redirects, 404 Error, Duplicate content	9

IV	Off-page Optimization Techniques 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 UX/UI, SEO and UX/UI, Best Practices. Local SEO and its importance, Local Searches, NAP, Directories, Top Local Search Signals, Reviews and Feedback. 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 Keyword Research Tools, On-page SEO Tools, Link Building Tools, Technical SEO Tools, Rank Tracking Tools, Analytics Tools, and Local SEO Tools.	6

Text Books

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”
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Useful Links

1	https://analytics.google.com/analytics/academy/course/6
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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 1,2,3; 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	7	6	20	33
3	Apply	7	7	20	34
4	Analyze	6	7	20	33
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	Final Year B. Tech., Sem VIII
Course Code	
Course Name	Human Computer Interaction
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	To illustrate the concepts of Human Computer Interaction (HCI) with emphasis on its use with few case study example.
2	To explain the challenges inherent in developing “HCI systems”
3	To explain core techniques in HCI design

Course Outcomes (CO) with Bloom’s Taxonomy Level

At the end of the course, the students will be able to,

CO1	Illustrate concepts of HCI and UI.	Apply
CO2	Analyse and design problem solving methods in HCI.	Analyze
CO3	Appraise applicability of HCI designs in solving engineering problems.	Evaluate
CO4	Build and demonstrate typical HCI and UI system.	Create

Module	Module Contents	Hours
I	Introduction Course objective and overview, Historical evolution of the field, The Human, The Computer, The Interaction.	7
II	Design processes Interaction Design basics, Concept of usability – definition and elaboration, HCI in the Software Process, Design Rules.	7
III	Implementation and Evaluation Implementation Support, Evaluation Techniques, Universal Design, Use Support.	6
IV	Models Cognitive Models, Socio – Organizational Issues and Stakeholders Requirements, Communication and Collaboration models.	6
V	Theories Task Analysis Dialog notations and Design Models of the system, Modeling Rich Interactions.	7
VI	Case Study of Modern Systems Group ware, Virtual Reality, Augmented Reality, Hypertext, Multimedia and World Wide web.	7

Text Books

1	Alan Dix, Janet Finlay, Gregory Abowd, Russell Beale, "Human Computer Interaction", 3rd Edition Pearson Education
2	B. Shneiderman, Designing the User Interface, Addison Wesley 2000 (Indian Reprint)
References	
1	Preece J, Rogers Y, Sharp H, Baniyon D, Holland S and Carey T, "Human Computer Interaction", Addison-Wesley, 1994
2	
Useful Links	
1	https://www.tutorialspoint.com/human_computer_interface/human_computer_interface_introduction
2	https://www.interaction-design.org/literature/topics/human-computer-interaction
3	https://nptel.ac.in/courses/106/103/106103115/
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		2										2		
CO2	2	3	2										2		
CO3	2	2	3										2		
CO4	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		5	5
2	Understand	5	5	10
3	Apply	5		10
4	Analyze	10	5	15
5	Evaluate		5	10
6	Create			10
Total		20	20	60