Walchand College of Engineering, Sangli

(Government Aided Autonomous Institute)

AY 2021-22

Course Information					
Programme		B.Tech.			
Class, Semester		First Year B.Tech., Sem I & II			
Course Code					
Course Name		**Engineering Physics**			
Desired Requisites:		Students are expected to know the basic concept in Physics.			
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 provide basic concepts to solve many engineering and technical issues.
2	To give deep insights into the understanding of engineering courses.
3	To encourage them to understand engineering and technical development.

Course Outcomes (CO) with Bloom's Taxonomy Level		
CO1	State Kepler's law, Planks quantum hypothesis, de-Broglie's law, Compton effect, Heisenberg's uncertainty principle, Describe optical phenomenon such as interference, diffraction polarization and in terms of wave model. Schrödinger's wave equations, Hall effect, Fermi-Dirac statistics. Seebeck effect	Remembering
CO2	Explain Planck's quantum hypothesis, Schrödinger's wave equations and their applications; Explain the methods of production and detection methods of ultrasonic waves and its applications, Show motion of particle under central force field, Discuss two body problem, energy equation and diagram,	Understanding
CO3	Classify transducers, and sensors and their applications. Classify solids on the basis of band theory; Explain fermi level and its behavior in metal, semiconductor and insulator. Solve the problems on electrical Conductivity and Hall effect.	Applying

Module	**Course Contents**	**Hours**
I	**Optics:** 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.	7
II	**Quantum Physics:** 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.	7
III	**Ultrasonics:** 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.	7
IV	**Solid State Physics:** Introduction, formation of energy bands in solid, classification of solid on the basis of band theory, number levels in band, density	6

	of states, Fermi-Dirac statistics, Fermi level, variation of Fermi level with change in temperature for semiconductor, electrical conductivity of metal and semiconductor, Hall effect, basic concept of p-n junction.	
V	**Gravitation and Central Force Motion:** Law of gravitation, Gravitational potential energy, Inertial and gravitational mass, Potential and field due to spherical shell and solid sphere, Motion of a particle under a central force field, Two body problem and its reduction to one-body problem and its solution, The energy equation and energy diagram, Kepler's Laws, Satellite in circular orbit and applications, Geosynchronous orbits.	8
VI	**Computer Instrumentation:** 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.	6

Text Books	
1	M. N. Avadhanulu and P. G. Kshirsagar, "*A Text book of Engineering Physics* ", S.Chand Pub.
2	R. K. Gaur and S. L. Gupta *"Engineering Physics",* Dhanpat Rai Publications, 2011
References	
1	Halliday, Resnic and Walker, *"Fundamentals of Physics"*, John Wiley, 9th edition 2011.
2	A. Beiser, *"Concepts of Modern Physics",* McGraw Hill International, 5th edition, 2003.
3	Ajoy Ghatak, *"Optics",* Tata McGraw Hill 5th edition, 2012.
4	P. M. Mathews, K. Venkatesan, *"Text Book of Quantum Mechanics",* Tata McGraw Hill
5	M.K Harbola, *"Engineering Mechanics",* Cengage 2nd edition, 2013.
6	D. Kleppner & R. Kolenkow, *"An Introduction to Mechanics",* McGraw Hill Education,
Useful Links	
1	For optics https://nptel.ac.in/courses/122/107/122107035/
2	For Quantum Physics https://nptel.ac.in/courses/122/106/122106034/
3	For Ultrasonics https://freevideolectures.com/course/3531/engineering-physics-i/8
4	For Solid State Physics https://nptel.ac.in/courses/115/105/115105099/
5	For Gravitation http://digimat.in/nptel/courses/video/115107121/L11.html
6	Basics of Instrumentation https://www.youtube.com/watch?v=qbKnW42ZM5c

CO-PO Mapping For All B.Tech. Programs

	Programme Outcomes (PO)												**PSO**		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2														
CO2	2														
CO3	2														

The strength of mapping is to be written as 1,2,3; Where, 1:Low, 2:Medium, 3:High

Assessment (for Theory Course)

The assessment is based on 2 in-semester examinations in the form of T1 (Test-1) and T2 (Test-2) of 20 marks each. Also there shall be 1 End-Sem examination (ESE) of 60 marks. T1 shall be typically on modules 1 and 2, T2 based typically on modules 3, 4 and ESE shall be on all modules with nearly 50% weightage on modules 1 to 4 and 50% weightage on modules 5, 6.

Assessment Plan based on Bloom's Taxonomy Level (Marks) For Theory Course

Bloom's Taxonomy Level		**T1**	**T2**	**ESE**	**Total**
1	Remember	8	8	24	40
2	Understand	8	8	24	40
3	Apply	4	4	12	20
4	Analyze	0	0	0	0
5	Evaluate	0	0	0	0
6	Create	0	0	0	0
Total		**20**	**20**	**60**	**100**

Walchand College of Engineering, Sangli

(Government Aided Autonomous Institute)

AY 2021-22

Course Information					
Programme		B.Tech.			
Class, Semester		First Year B.Tech., Sem I			
Course Code					
Course Name		Engineering Mathematics- I			
Desired Requisites:		Students are expected to know the basic concept in Mathematics.			
Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	3 Hrs/week	**T1**	**T2**	**ESE**	**Total**
Tutorial	1 Hrs/week	20	20	60	100
Practical	-				
Interaction	-	**Credits: 4**			

Course Objectives	
1	To develop mathematical skills and enhance thinking power of students.
2	To introduce fundamental concepts of mathematics and their applications in engineering fields

Course Outcomes (CO) with Bloom's Taxonomy Level		
CO1	Illustrating mathematical concepts in engineering field.	Understanding
CO2	Use mathematical and computational methods to solve problems in science and engineering field	Applying

Module	**Course Contents**	**Hours**
I	**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.	6
II	**Calculus:** Rolle's theorem, Mean value theorem, Taylor's and Maclaurin's theorem with remainders, L'hospital rule and indeterminate forms	6
III	**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.	7
IV	**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.	8
V	**First order ODE and its application**: Exact, Linear, Bernoulli's equations, Euler's equations, Orthogonal trajectory, applications to simple electric circuit.	8
VI	**Curve tracing:** Tracing of curves for Cartesian and polar coordinate.	5

Text Books	
1	A Text Book of Applied Mathematics, Vol I and II", P. N. and J. N. Wartikar, Vidyarthi Griha Prakashan, Pune, 2006.
2	Higher Engineering Maths", B .S. Grewal, Khanna Publication, 2005, 39th Edition.

References	
1	Advanced Engineering Mathematics", Erwin Kreyszig, Wiley Eastern Limited Publication, 1978, 1st Edition
2	Advanced Engineering Mathematics", Wylie C.R., Tata McGraw Hill Publication, 1999, 8th Edition.
3	Advanced Engineering Mathematics", H. K. Dass, S. Chand & Company Ltd., 1988, 1st Edition

Useful Links

1	https://engineering-computer-science.wright.edu
2	https://www.classcentral.com/course/edx-introduction-to-engineering-mathematics
3	https://nptel.ac.in/courses/111/105/111105035/
4	https://nptel.ac.in/courses/122/104/122104017/

CO-PO Mapping For All B.Tech. Programs

	Programme Outcomes (PO)												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2														
CO2	2														

The strength of mapping is to be written as 1,2,3; Where, 1:Low, 2:Medium, 3:High

Assessment (for Theory Course)

The assessment is based on 2 in-semester examinations in the form of T1 (Test-1) and T2 (Test-2) of 20 marks each. Also there shall be 1 End-Sem examination (ESE) of 60 marks. T1 shall be typically on modules 1 and 2, T2 based typically on modules 3, 4 and ESE shall be on all modules with nearly 50% weightage on modules 1 to 4 and 50% weightage on modules 5, 6.

Assessment Plan based on Bloom's Taxonomy Level (Marks) For Theory Course

Bloom's Taxonomy Level		**T1**	**T2**	**ESE**	**Total**
1	Remember	5	5	20	30
2	Understand	10	10	20	40
3	Apply	5	5	20	30
4	Analyze	0	0	0	0
5	Evaluate	0	0	0	0
6	Create	0	0	0	0
Total		**20**	**20**	**60**	**100**

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AY 2021-22

Course Information					
Programme		B.Tech.			
Class, Semester		First Year B.Tech., Sem I &II			
Course Code					
Course Name		Engineering Mechanics			
Desired Requisites:		Knowledge of higher secondary level Physics			
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 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 Outcomes (CO) with Bloom's Taxonomy Level		
CO1	Apply laws and basic concepts of mechanics of rigid bodies.	Understanding
CO2	Analyze system of forces in Statics and Dynamics.	Analyzing
CO3	Apply concept of mechanics to solve engineering problems.	Applying

Module	**Course Contents**	**Hours**
I	**Equilibrium of Forces**: Fundamental concepts and axioms, Types of Force Systems, Composition and resolution of forces, Moment of a force, Couple, Resultant of planar force systems. Equilibrium of forces- Free body diagrams, Equations of equilibrium, Equilibrium of planar systems, Equilibriums of beams- Types of loads and supports. Friction-Laws of friction, equilibrium of bodies on inclined plane, applications- problem involving wedges, ladders etc.	8
II	**Virtual work and Moment of inertia:**Principle of Virtual work-applications to statically determinate simple and compound beams. Centre of gravity and Centroid, Moment of inertia, Radius of gyration, Mass-Moment of inertia.	6
III	**Analysis of plane frames:** Pin-jointed statically determinate plane trusses-Assumptions, imperfect, perfect and redundant trusses, Analysis of statically determinate trusses, method of joints, method of sections and graphical method.	6
IV	**Kinematics of particles:** Rectilinear motion of a particle under uniform and variable acceleration, Equations of motion, Motion under gravity, Relative motion, Motion of a Projectile, Curvilinear motion of a particle, Relation between linear and angular motion.	7
V	**Kinetics of Particles:** Newton's laws of motion, D'Alemberts principle. Rectilinear motion- Motion on a rough inclined plane, motion of a lift, motion of connected bodies, Circular motion- Centripetal and centrifugal force, motion of a bicycle, Car along a curved track, super elevation of roads and railway curves, Kinetics of rotation-Torque, mass moment of inertia, problems on centroidal and non centroidal rotation.	7
VI	**Kinetics :** Work energy method- potential energy, kinetic energy, law of conservation of energy. Impulse momentum method. Collisions- impact, collision of bodies, coefficient of restitution, loss of kinetic energy due to impact.	6

Text Books	
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.
Useful Links	
1	https://nptel.ac.in
2	https://www.coursera.org/learn/engineering-mechanics-statics
3	https://swayam.gov.in/

CO-PO Mapping For All B.Tech. Programs

	Programme Outcomes (PO)												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	2											1		
CO2	3	2											1		
CO3	3	2											1		

The strength of mapping is to be written as 1,2,3; Where, 1:Low, 2:Medium, 3:High

Assessment (for Theory Course)

The assessment is based on 2 in-semester examinations in the form of T1 (Test-1) and T2 (Test-2) of 20 marks each. Also there shall be 1 End-Sem examination (ESE) of 60 marks. T1 shall be typically on modules 1 and 2, T2 based typically on modules 3, 4 and ESE shall be on all modules with nearly 50% weightage on modules 1 to 4 and 50% weightage on modules 5, 6.

Assessment Plan based on Bloom's Taxonomy Level (Marks) For Theory Course

Bloom's Taxonomy Level		T1	T2	ESE	Total
1	Remember	0	0	0	**0**
2	Understand	10	10	30	**50**
3	Apply	05	05	15	**25**
4	Analyze	05	05	15	**25**
5	Evaluate	0	0	0	**0**
6	Create	0	0	0	**0**
Total		**20**	**20**	**60**	**100**

Walchand College of Engineering, Sangli

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AY 2021-22

Course Information					
Programme		B.Tech.			
Class, Semester		First Year B.Tech., Sem I &II			
Course Code					
Course Name		Communication Skills			
Desired Requisites:		Higher Secondary Level			
Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	2 Hrs/week	**T1**	**T2**	**ESE**	**Total**
Tutorial	1 Hrs/week	20	20	60	100
Practical	-				
Interaction	-	**Credits: 3**			

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

Course Outcomes (CO) with Bloom's Taxonomy Level		
CO1	Communicate clearly, precisely and competently in different scenario	Applying
CO2	Demonstrate the information through oral , written and graphic messages	Understanding
CO3	Acquire basic proficiency in English including reading and listening comprehension ,writing and speaking skills	Remembering

Module	**Course Contents**	**Hours**
I	**Module 1: Sentence Structure and Vocabulary Building:** Subject Verb Agreement, Modal verbs, Question tags, Connectives, Synonyms, Antonyms and Standard abbreviations, Redundancies, Misplaced Modifiers Passives.	5
II	**Module 2 : Fundamentals of Communication:** Features and Functions, Importance of Communication, The Communication Process, Barriers and Breakdown of Communication, Communication in an Organization, Upward communication, Downward communication, Horizontal communication, Diagonal communication, Informal communication / Grapevine communication.	3
III	**Module 3 : Nature and Style of Writing :** Describing, Defining, Classifying, Providing examples or evidence, Writing Introduction and Conclusion	3
IV	**Module 4 : A. Non Verbal Communication :** Kinesics or Body Language, Proxemics : Space Distance, Haptic, Chronemics, Nonverbal Barriers. **Vocalic** : **Paralinguistic features: 1.**Pitch 2.Volume 3.Pauses 4. Rate of words/minute **B. Listening Skills:-** 1.Process of Listening 2.Types of Listening 3. Barriers to effective Listening	4
V	**Module 5 : A. Oral Communication:-** 1. Speeches for different Occasions (Welcome Speech , Introductory Speech, Vote of Thanks Speech), 2. Group Presentations 3. Group Discussions 4. Individual Presentations 5. Job Interviews **B. Basics of Phonetics :-** 1. Improper Pronunciation 2. Classification of Sounds in English 3. Word Stress 4. Sentence Stress or Intonation 5. Pronunciation and Articulation	5
VI	**Module 6 : Writing Communication** **A. Basic Writing Skills : 1.**Paragraph Writing 2. Comprehension 3.Essay Writing 4.Sentence Structures 5. Use of phrases & clauses in sentences	8

	6.Importance of proper punctuations 7. Creating coherence 8.Organising the principles of paragraphs in documents 9.Techniques for writing precisely **B. Business Correspondence** : 1. Job Applications 2. Complaint Letters and Adjustment Letters 3. Inquiry and Order **C**. **Official Correspondence : 1**. Memorandums 2. Circulars 3. Notices **D** .**Report Writing** : 1. Individual Report 2. Lab Report 3. Inspection Reports	

Text Books	
1	Sanjay Kumar, Pushplata , *Communication Skills*, Oxford University Press, First edition ,2012
2	Ashraf Rizvi ,Effective Technical Communication, Tata McGraw Hills publishing Company 2006
References	
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	F.T.Wood,Remedial English Grammar, Macmillan, 2007
5	Andrea J.Rutherford,Phd. *Basic Communication Skills for Technology*, Pearson Education Asia,2001
6	Exercises in Spoken English, Parts 1 and II CIEFL, Hyderabad , Oxford University Press
Useful Links	
1	www.oupinheonline.com
2	www.scitechpblications.com

CO-PO Mapping For All B.Tech. Programs

	Programme Outcomes (PO)												**PSO**		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1										3					
CO2										2					
CO3										2					

The strength of mapping is to be written as 1,2,3; Where, 1:Low, 2:Medium, 3:High

Assessment (for Theory Course)

The assessment is based on 2 in-semester examinations in the form of T1 (Test-1) and T2 (Test-2) of 20 marks each. Also there shall be 1 End-Sem examination (ESE) of 60 marks. T1 shall be typically on modules 1 and 2, T2 based typically on modules 3, 4 and ESE shall be on all modules with nearly 50% weightage on modules 1 to 4 and 50% weightage on modules 5, 6.

Assessment Plan based on Bloom's Taxonomy Level (Marks) For Theory Course

Bloom's Taxonomy Level		**T1**	**T2**	**ESE**	**Total**
1	Remember	10	10	24	44
2	Understand	10	10	36	56
3	Apply	0	0	0	0
4	Analyze	0	0	0	0
5	Evaluate	0	0	0	0
6	Create	0	0	0	0
Total		**20**	**20**	**60**	**100**

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AY 2021-22

Course Information					
Programme		B.Tech.			
Class, Semester		First Year B.Tech., Sem I &II			
Course Code					
Course Name		Programming For Problem Solving.			
Desired Requisites:		Basic course of software and hardware programming.			
Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	2 Hrs/week	**T1**	**T2**	**ESE**	**Total**
Tutorial	-	20	20	60	100
Practical	-				
Interaction	-	**Credits: 2**			

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

Course Outcomes (CO) with Bloom's Taxonomy Level		
CO1	Paraphrase the basics of programming	Understanding
CO2	Convert the algorithms to programs	Understanding
CO3	Apply programming language principles and constructs to solve problems	Applying

Module	**Course Contents**	**Hours**
I	**Introduction to Programming** Introduction to components of a computer system (disks, memory, processor, where a program is stored and executed, operating system, compilers etc.) Idea of Algorithm: steps to solve logical and numerical problems. Representation of Algorithm: Flowchart/Pseudocode with examples. From algorithms to programming Language: source code, variables (with data types) variables and memory locations, Syntax and Logical Errors in compilation, object and executable code.	04
II	**Arithmetic expressions, Precedence constraints, Conditional Branching & Loops** **Arithmetic expressions & Precedence :** 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 Conditional **Branching & Loops:** Statements and blocks, if and switch statements, Loops ,while, do-while and for statements, break, continue, goto and labels.	04
III	**Arrays** Arrays- concepts, declaration, definition, accessing elements, storing elements, arrays and functions, two-dimensional arrays, Character arrays, Strings, and applications of arrays.	05
IV	**Functions and Recursion** Designing structured programs, Functions basics, parameter passing, call by value, idea of call by reference, storage classes like extern, auto, register, static, scope rules, block structure, user defined functions, Recursion with examples.	04
V	**Pointers, Structures and Union** Pointers- concepts, initialization of pointer variables, pointers and function arguments, address arithmetic, Character pointers and functions, pointer to pointer. Derived types: structures- declaration, definition and initialization	05

	of structures, accessing structures, nested structures, arrays of structures, structures and functions, pointers to structures, self-referential structures, and unions.	
VI	**Introduction to File handling** 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.	04

Text Books	
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.
Useful Links	
1	http://www.learnvern.com/course/c-tutorials/
2	https://www.udemy.com/c-programming-for-beginners/
3	https://www.geeksforgeeks.org/c-programming-language/
4	https://codeforwin.org/

CO-PO Mapping For All B.Tech. Programs

	Programme Outcomes (PO)												**PSO**		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	1													
CO2	2	1													
CO3	3	2	1												

The strength of mapping is to be written as 1,2,3; Where, 1:Low, 2:Medium, 3:High

Assessment (for Theory Course)

The assessment is based on 2 in-semester examinations in the form of T1 (Test-1) and T2 (Test-2) of 20 marks each. Also there shall be 1 End-Sem examination (ESE) of 60 marks. T1 shall be typically on modules 1 and 2, T2 based typically on modules 3, 4 and ESE shall be on all modules with nearly 50% weightage on modules 1 to 4 and 50% weightage on modules 5, 6.

Assessment Plan based on Bloom's Taxonomy Level (Marks) For Theory Course

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

Walchand College of Engineering, Sangli

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AY 2021-22

Course Information

Programme	B.Tech.
Class, Semester	First Year B.Tech., Sem I &II
Course Code	
Course Name	Engineering Mechanics Laboratory.
Desired Requisites:	Engineering Mechanics

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	-	**LA1**	**LA2**	**Lab ESE**	**Total**
Tutorial	-	30	30	40	100
Practical	2 Hrs/week				
Interaction	-	**Credits: 1**			

Course Objectives

1	To conduct the experiments to verify the principles of mechanics.
2	To execute the graphical methods to verify the analytical solutions.

Course Outcomes (CO) with Bloom's Taxonomy Level

CO1	Demonstrate verification of laws and basic principles of mechanics through experiments.	Applying
CO2	Execute the experiments to verify the laws of mechanics analytically and graphically.	Applying

List of Experiments / Lab Activities

List of Experiments/ Lab Activities- Any Eight Experiments

1.	To verify of law of triangle of forces.
2.	To verify of law of polygon of forces.
3.	Determine the support reactions for Simply Supported Beam.
4.	To verify the principle of moments with the help of Bell crank lever apparatus.
5.	Determine the coefficient of friction for motion on horizontal plane.
6.	Determine the coefficient of friction for motion on inclined plane.
7.	Determine efficiency of simple screw jack apparatus.
8.	Determine efficiency of worm and worm wheel apparatus.
9.	Graphical solution of statically determinate Beams.
10.	Graphical solution of pin jointed perfect plane frames.

Text Books

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

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.

Useful Links

1	https://nptel.ac.in
2	https://www.coursera.org/learn/engineering-mechanics-statics
3	https://swayam.gov.in/

CO-PO Mapping For All B.Tech. Programs

	Programme Outcomes (PO)												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2			2										
CO2	3	2			2										

The strength of mapping is to be written as 1,2,3; Where, 1:Low, 2:Medium, 3:High

Assessment (for Lab. Course)

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

Bloom's Taxonomy Level	LA1	LA2	Lab ESE	Total
Remember				
Understand	5	5	10	**20**
Apply	10	10	15	**35**
Analyze	15	15	15	**45**
Evaluate				
Create				
Total	**30**	**30**	**40**	**100**

Walchand College of Engineering, Sangli

(Government Aided Autonomous Institute)

AY 2021-22

Course Information

Programme	B.Tech.
Class, Semester	First Year B.Tech., Sem I &II
Course Code	
Course Name	Workshop Practices LAB
Desired Requisites:	NA

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	-	**LA1**	**LA2**	**Lab ESE**	**Total**
Tutorial	-	30	30	40	100
Practical	2 Hrs/week				
Interaction	-	**Credits: 1**			

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 Outcomes (CO) with Bloom's Taxonomy Level

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

CO1	Describe the methods, operations and processes of manufacturing	Apply
CO2	Summarize the simple mechanical systems, machines, equipment's, the basic working of cutting tools for manufacturing.	Analyze
CO3	Use of chemical etching technique for making the PCB for electronic applications.	Evaluate

List of Experiments / Lab Activities

List of Experiments/ Lab Activities- Any Eight Experiments

List of Experiments:

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. (6 Hrs.)

   In case of mini-projects, drawing, presentations etc, write the relevant details of the same.

Text Books

1	Raghuwanshi B. S.,"A Course in Workshop Technology I",Dhanpat Rai Publications,10th Ed.2009
2	S. K. Hajra Choudhury and A. K. HajraChoudhary,"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
3	Gowri P. Hariharan and A. Suresh Babu,"Manufacturing Technology – I" Pearson Education, 2008

Useful Links

1	https://www.vlab.co.in/broad-area-mechanical-engineering
2	http://vlabs.iitb.ac.in/vlab/labsme.html
3	https://drive.google.com/file/d/1tp5yV2ghp_Slub58S7iKnvvJyoEwQVYq/view

CO-PO Mapping For All B.Tech. Programs

	Programme Outcomes (PO)												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1				1											
CO2				1											
CO3					1										

The strength of mapping is to be written as 1,2,3; Where, 1:Low, 2:Medium, 3:High

Assessment (for Lab. Course)

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.

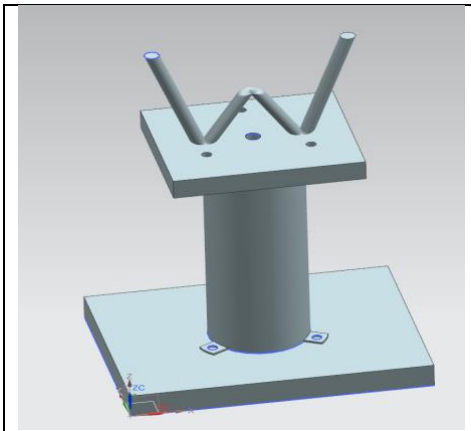
Assessment	Based on	Conducted by	Typical Schedule (for 26-week Sem)	Marks
LA1	Lab activities, attendance, journal	Lab Course Faculty	During Week 1 to Week 6 Marks Submission at the end of Week 6	30
LA2	Lab activities, attendance, journal	Lab Course Faculty	During Week 7 to Week 12 Marks Submission at 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.

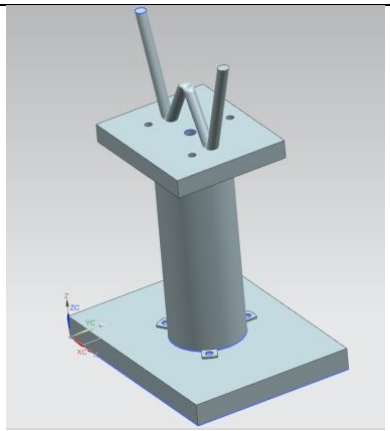
Assessment Plan based on Bloom's Taxonomy Level

Bloom's Taxonomy Level	LA1	LA2	Lab ESE	Total
Remember				
Understand				
Apply	15	15	20	**50**
Analyze	10	10	10	**30**
Evaluate	5	5	10	**20**
Create				
Total	**30**	**30**	**40**	**100**

Job Drawings [The detailed drawing of each section will be finalized after finalizing the proper dimensions of individual jobs and availability of respective job raw material]

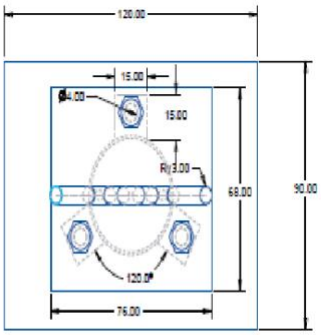


View1



View2

All dimensions are in mm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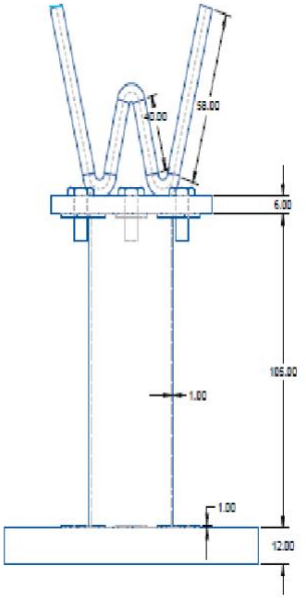
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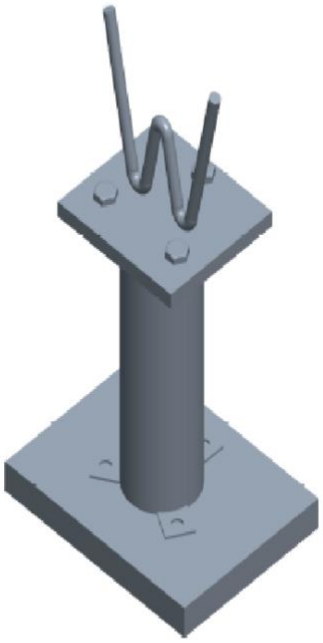

Walchand College of Engineering, Sangli

(Government Aided Autonomous Institute)

AY 2021-22

Course Information					
Programme		B.Tech.			
Class, Semester		First Year B.Tech., Sem I &II			
Course Code					
Course Name		Programming for Problem Solving Lab			
Desired Requisites:		Basic course of software and hardware programming			
Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	-	**LA1**	**LA2**	**Lab ESE**	**Total**
Tutorial	-	30	30	40	100
Practical	2 Hrs/week				
Interaction	-	**Credits: 1**			

Course Objectives	
1	To impart problem-solving and programming skills to translate text described problems into programs, written using the Programming language with the help of language constructs.
2	To demonstrate use of computer language constructs and principles such as: conditional branching loops, block structures, functions, and input/output for implementing programs to solve problems.

Course Outcomes (CO) with Bloom's Taxonomy Level		
CO1	Illustrate the use of different Language constructs and principles of programming language using a programming environment/tool	Apply
CO2	Implement programs using programming language in a programming environment/using programming tool to solve problems	Apply
CO3	Examine a given program to identify its output	Apply

List of Experiments / Lab Activities	
List of Experiments/ Lab Activities- Any Eight Experiments	
1.	Familiarization with programming environment IDE (Integrated development environment).
2	Writing algorithms to solve problems
3	Variable types and type conversions
4	Programs to demonstrate different operators and their order precedence
5	Programs to solve simple computational problems using arithmetic expressions e.g. simple and compound interest
6	Programs to demonstrate problems on conditional branching e.g. roots of quadratic equation, finding a maximum/minimum value
7	Programs to show statement block, conditional statement
8	Programs to show different types of iteration / loop.
9	Implementation of iterative problems e.g., sum of series
10	Programs to demonstrate matrix problems, string operations, sorting problems.
11	Programsto implement numerical methods problems(Root finding, numerical differentiation, and numerical integration): using array, function and recursion.
12	Programs to illustrate use of pointer with simple data type (create pointer variable, assign value, access value and show address using (* and &).
13	Programs to solve the problems using pointers and structures e.g. swap two numbers.
14	File handling: Study and implementation file operations
15	Programs to demonstrate simple read and write operation on the external text file.
16	Case study to demonstrate basic programming constructs

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

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

Useful Links	
1	http://www.learnvern.com/course/c-tutorials/
2	https://www.udemy.com/c-programming-for-beginners/
3	https://www.geeksforgeeks.org/c-programming-language/
4	https://codeforwin.org/

CO-PO Mapping For All B.Tech. Programs

	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				3	2										

The strength of mapping is to be written as 1,2,3; Where, 1:Low, 2:Medium, 3:High

Assessment (for Lab. Course)

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

Bloom’s Taxonomy Level	LA1	LA2	Lab ESE	Total
Remember			5	**5**
Understand			5	**5**
Apply	20		10	**30**
Analyze		10	5	**15**
Evaluate	10		5	**15**
Create		20	10	**30**
Total	**30**	**30**	**40**	**100**

Walchand College of Engineering, Sangli

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AY 2021-22

Course Information					
Programme		B.Tech.			
Class, Semester		First Year B.Tech., Sem I &II			
Course Code					
Course Name		Engineering Physics Lab.			
Desired Requisites:		Students are expected to know the basic practical knowledge upto HSC			
Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	-	**LA1**	**LA2**	**Lab ESE**	**Total**
Tutorial	-	30	30	40	100
Practical	2 Hrs/week				
Interaction	-	**Credits: 1**			

Course Objectives		
1	To gain practical knowledge by applying the experimental methods to correlate with the physics theory.	
2	To learn the usage of electrical and optical systems for various measurements.	
3	To Apply the analytical techniques and graphical analysis to the experimental data.	
Course Outcomes (CO) with Bloom's Taxonomy Level		
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.	Applying

List of Experiments / Lab Activities.	
List of Experiments/ Lab Activities- Any Eight Experiments	
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.
Text Books	
1	C. L. Arora *"Practical Physics"* S. Chand & Co Edition 2009.
2	P.R. Sasi Kumar *"Practical Physics"*, PHI Learning Pvt.Ltd 1st edition 2011.
References	
1	Halliday, Resnic and Walker, *"Fundamentals of Physics"*, John Wiley, 9th edition 2011.
2	A. Beiser, *"Concepts of Modern Physics",* McGraw Hill International, 5th edition, 2003.
3	Ajoy Ghatak, *"Optics",* Tata McGraw Hill 5th edition, 2012.
Useful Links	
1	https://nptel.ac.in/courses/115/105/115105121/
2	https://www.iitg.ac.in/cet/nptel.html
3	http://nptel.ac.in/video.php?subjectId=117106091

CO-PO Mapping For All B.Tech. Programs															
	Programme Outcomes (PO)												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	1	1													
The strength of mapping is to be written as 1,2,3; Where, 1:Low, 2:Medium, 3:High															

Assessment (for Lab. Course)

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

Bloom's Taxonomy Level	LA1	LA2	Lab ESE	Total
Remember	10	10	15	**35**
Understand	10	10	10	**30**
Apply	10	10	15	**35**
Analyze	0	0	0	**0**
Evaluate	0	0	0	**0**
Create	0	0	0	**0**
Total	**30**	**30**	**40**	**100**

Walchand College of Engineering, Sangli

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Course Information					
Programme		B.Tech.			
Class, Semester		First Year B.Tech., Sem I &II			
Course Code					
Course Name		Engineering Chemistry			
Desired Requisites:		Chemistry course at secondary and higher secondary level			
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 make student familiar with engineering properties associated with different materials to use them successfully in practice.
2	To provide knowledge and significance of characterization and chemical analysis for using materials in different engineering applications.

Course Outcomes (CO) with Bloom's Taxonomy Level		
CO1	Explain chemical analysis, thermal analysis, water chemistry, phase rule. Types of polymers and its application and water's industrial applications. Draw schematic of water softeners, phase diagrams, Thermo grams, calorimeter and fuel cells setups.	Understanding
CO2	Classify types of chemical analysis, hard water, polymers, fuel, fuel cells and thermal analysis.	Understanding
CO3	Calculate concentration of solutions, % or GF of analyte gravimetrically, hardness of water, Calorific values	Applying

Module	**Course Contents**	**Hours**
I	**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.	8
II	**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, Ion exchange method of water softening, Dissolved oxygen(DO), Biological Oxygen Demand (BOD) and Chemical Oxygen Demand (COD) its significance.	5
III	**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.	6
IV	**Polymers-** Polymer, Polymerization reactions – Addition, Condensation and Co polymerization. Comparison of addition and condensation polymerization and polymers, Plastics and its types- Thermoplastic and thermosetting plastics, comparison Thermoplastic and thermosetting plastics, Properties and Uses of Poly Vinyl Chloride (PVC), Bakelite, Epoxy resin, Fiber Reinforced Plastic (FRP), Rubber and properties of Rubber, vulcanization of natural rubber.	7
V	**Thermal Analysis** – Thermal analysis and its types, Thermal events,	

	Thermal analysis methods Thermo gravimetric Analysis (TGA), Differential Thermal Analysis (DTA)and Differential Scanning Calorimetry (DSC) w.r.t. Principle, instrumentation, and applications, Interpretation of Thermogram	6
VI	**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.	6

Text Books	
1	S.K. Singh, "Engineering Chemistry", New Age Publication, 3rd Edition , 2005.
2	Shasi Chawla, "Engineering Chemistry", Dhanpat Rai Publication, 3rd Edition , 2003.
3	Jain P.C. and Jain Monika, "Engineering Chemistry", Dhanpat Rai Publication, 16th Edition, 2013
References	
1	O G Palanna, "Engineering Chemistry" Tata McGraw Hill 2009.
2	Mendham, R.C. Denney, J.D. Barnes, M.J.K Thomas, "Quantitative Chemical analysis", Vogel's Pearson Education, 6th Edition , 2008.
3	S.S Dara, "Engineering Chemistry" S. Chand and Company 2008.
4	Askeland and Phule , "The Science and Engineering of Materials" Thomson Publication 4th Edition ,2003
Useful Links	
1	https://edu.rsc.org/resources A free resource for Chemistry teachers and students of all levels, including higher education, hosted by Royal Society of Chemistry.
2	https://www.digimat.in/nptel/courses/video/122106028/L01.html
3	https://onlinecourses.nptel.ac.in/noc21_cy49/preview
4	https://www.coursera.org/browse/physical-science-and-engineering/chemistry

CO-PO Mapping For All B.Tech. Programs

	Programme Outcomes (PO)												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2														
CO2	2														
CO3	2														

The strength of mapping is to be written as 1,2,3; Where, 1:Low, 2:Medium, 3:High

Assessment (for Theory Course)

The assessment is based on 2 in-semester examinations in the form of T1 (Test-1) and T2 (Test-2) of 20 marks each. Also there shall be 1 End-Sem examination (ESE) of 60 marks. T1 shall be typically on modules 1 and 2, T2 based typically on modules 3, 4 and ESE shall be on all modules with nearly 50% weightage on modules 1 to 4 and 50% weightage on modules 5, 6.

Assessment Plan based on Bloom's Taxonomy Level (Marks) For Theory Course

Bloom's Taxonomy Level		**T1**	**T2**	**ESE**	**Total**
1	Remember	6	6	20	32
2	Understand	8	8	25	41
3	Apply	6	6	15	27
4	Analyze	0	0	0	0
5	Evaluate	0	0	0	0
6	Create	0	0	0	0
Total		**20**	**20**	**60**	**100**

Walchand College of Engineering, Sangli

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AY 2021-22

Course Information					
Programme		B.Tech.			
Class, Semester		First Year B.Tech., Sem II			
Course Code					
Course Name		Engineering Mathematics- II			
Desired Requisites:		Students are expected to know the basic concept in Mathematics.			
Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	3 Hrs/week	**T1**	**T2**	**ESE**	**Total**
Tutorial	1Hrs/week	20	20	60	100
Practical	-				
Interaction	-	**Credits: 4**			

Course Objectives	
1	To develop mathematical skills and enhance thinking power of students.
2	To introduce fundamental concepts of mathematics and their applications in engineering fields

Course Outcomes (CO) with Bloom's Taxonomy Level		
CO1	Illustrating mathematical concepts in engineering field.	Understanding
CO2	Use mathematical and computational methods to solve problems in science and engineering field	Applying

Module	**Course Contents**	**Hours**
I	**Beta-Gamma Functions:** Definition of Beta, Gamma functions and properties of Beta Gamma functions.	5
II	**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.	10
III	**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.	6
IV	**Probability theory**: Introduction, Sample Space, Events, Axioms of probability, Conditional probability Baye's Theorem	6
V	**Statistics:** Correlation, Regression, Curve-fitting.	6
VI	**Probability Distribution:** Random Variable, Binomial distribution, Poisson distribution, Normal distribution.	7

Text Books	
1	A Text Book of Applied Mathematics, Vol I and II", P. N. and J. N. Wartikar,
2	Higher Engineering Maths", B .S. Grewal, Khanna Publication, 2005, 39th Edition.
3	Fundamentals of Mathematical Statistics and probability S.C. Gupta 2014 ,S. Chand &Sons

References	
1	Advanced Engineering Mathematics", Erwin Kreyszig, Wiley Eastern 1st edition 1978
2	Advanced Engineering Mathematics", Wylie C.R., Tata McGraw Hill 1999, 8th Edition.
3	Advanced Engineering Mathematics", H. K. Dass, S. Chand ,1988, 1st Edition
4	Engineering Mathematics (Vol.-I)", S. S. Sastry, Prentice Hall Publication, 2006, 3rd Edition.

Useful Links	
1	https://engineering-computer-science.wright.edu
2	https://www.classcentral.com/course/edx-introduction-to-engineering-mathematics
3	https://nptel.ac.in/courses/111/105/111105035/
4	https://nptel.ac.in/courses/122/104/122104017/

CO-PO Mapping For All B.Tech. Programs

	Programme Outcomes (PO)												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2														
CO2	2														

The strength of mapping is to be written as 1,2,3; Where, 1:Low, 2:Medium, 3:High

Assessment (for Theory Course)

The assessment is based on 2 in-semester examinations in the form of T1 (Test-1) and T2 (Test-2) of 20 marks each. Also there shall be 1 End-Sem examination (ESE) of 60 marks. T1 shall be typically on modules 1 and 2, T2 based typically on modules 3, 4 and ESE shall be on all modules with nearly 50% weightage on modules 1 to 4 and 50% weightage on modules 5, 6.

Assessment Plan based on Bloom's Taxonomy Level (Marks) For Theory Course

Bloom's Taxonomy Level		**T1**	**T2**	**ESE**	**Total**
1	Remember	5	5	20	30
2	Understand	10	10	20	40
3	Apply	5	5	20	30
4	Analyze	0	0	0	0
5	Evaluate	0	0	0	0
6	Create	0	0	0	0
Total		**20**	**20**	**60**	**100**

Walchand College of Engineering, Sangli

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AY 2021-22

Course Information					
Programme		B.Tech.			
Class, Semester		First Year B.Tech., Sem I &II			
Course Code					
Course Name		Engineering Graphics and AutoCAD			
Desired Requisites:		Basic Knowledge of Different Types of Curves			
Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	2 Hrs/week	**T1**	**T2**	**ESE**	**Total**
Tutorial	-	20	20	60	100
Practical	-				
Interaction	-	**Credits: 2**			

Course Objectives	
1	Introduce 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 Outcomes (CO) with Bloom's Taxonomy Level		
CO1	Understanding Principles of Engineering and Computer Graphics	Understanding
CO2	Outline projection of engineering objects	Understandinge
CO3	Demonstrating Principles of Engineering, Computer Graphics through drafting software	Demonstrating

Module	**Course Contents**	**Hours**
I	**Introduction to Engineering Drawing** 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	4
II	**Orthographic Projections** 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	5
III	**Projections of Regular Solids Sections and Sectional Views of Right Angular Solids** 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	4
IV	**Isometric Projections** 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;	4

	Problems from the above units should also be practiced on computer aided drafting software	
V	**Introduction to Computer Aided Sketching** 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.	5
VI	**Annotations, layering & other functions** 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;	4

Text Books	
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
Useful Links	
1	https://nptel.ac.in/courses/112/103/112103019/
2	https://nptel.ac.in/courses/105/104/105104148/
3	https://www.youtube.com/watch?v=xXdpkQXDuMw&list=PL9RcWoqXmzaJT-fliqTSwUjWU4zCX_H2A

CO-PO Mapping For All B.Tech. Programs

	Programme Outcomes (PO)												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3				2					1		1	2		
CO2			2												
CO3					3					1					

The strength of mapping is to be written as 1,2,3; Where, 1:Low, 2:Medium, 3:High

Assessment (for Theory Course)

The assessment is based on 2 in-semester examinations in the form of T1 (Test-1) and T2 (Test-2) of 20 marks each. Also there shall be 1 End-Sem examination (ESE) of 60 marks. T1 shall be typically on modules 1 and 2, T2 based typically on modules 3, 4 and ESE shall be on all modules with nearly 50% weightage on modules 1 to 4 and 50% weightage on modules 5, 6.

Assessment Plan based on Bloom's Taxonomy Level (Marks) For Theory Course					
Bloom's Taxonomy Level		**T1**	**T2**	**ESE**	**Total**
1	Remember				
2	Understand	5	5	20	30
3	Apply	10	10	30	50
4	Analyze	5	5	10	20
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.			
Class, Semester		First Year B.Tech., Sem I &II			
Course Code					
Course Name		Basic Electrical Engineering			
Desired Requisites:					
Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	3 Hrs/week	**T1**	**T2**	**ESE**	**Total**
Tutorial	-	20	20	60	100
Practical	-				
Interaction	-	**Credits: 3**			

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

Course Outcomes (CO) with Bloom's Taxonomy Level		
CO1	**Explain** principles, construction and working of electrical machines. .	Understand
CO2	**Solve** electrical and magnetic circuits. .	Apply

Module	**Course Contents**	**Hours**
I	**DC Circuits:-** Review of R-L-C- Electrical circuit elements, KCL and KVL. Star- delta conversion, voltage and current sources. Thevenin, Norton and Superposition, Maximum power transfer Theorems.	6
II	**AC Circuits:-**Representation of sinusoidal waveforms, peak, RMS values, phasor representation real, reactive and apparent power. Analysis of single-phase, ac circuits consisting of R, L, C, RL, RC, RLC (series and parallel) circuits and three-phase balanced circuits. Voltage and current relations in star and delta..	5
III	**DC Machines:-**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.	6
IV	**Transformers:-**Magnetic circuits, Construction, working principle and types of single-phase transformer, open circuit and short circuit tests: Losses, efficiency, all-day efficiency and regulation. Autotransformer.	7
V	**AC Machines:-**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.	6
VI	**Wiring, Electrical Installations and Components of LT Switchgear** Switch fuse unit, MCB, ELCB, MCCB. Types of wire and cables. Staircase, Go-down and Domestic wiring, CFL, LED, Fluorescent tube. Lighting schemes, Earthing, types of batteries, characteristics of batteries.	6

Text Books	
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.
3	B.L Theraja,"*A Textbook of Electrical Technology*", S Chand Publication, 2013.

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

Useful Links	
1	https://nptel.ac.in/courses/108/105/108105053/

CO-PO Mapping For All B.Tech. Programs

	Programme Outcomes (PO)												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3														
CO2		3													

The strength of mapping is to be written as 1,2,3; Where, 1:Low, 2:Medium, 3:High

Assessment (for Theory Course)

The assessment is based on 2 in-semester examinations in the form of T1 (Test-1) and T2 (Test-2) of 20 marks each. Also there shall be 1 End-Sem examination (ESE) of 60 marks. T1 shall be typically on modules 1 and 2, T2 based typically on modules 3, 4 and ESE shall be on all modules with nearly 50% weightage on modules 1 to 4 and 50% weightage on modules 5, 6.

Assessment Plan based on Bloom's Taxonomy Level (Marks) For Theory Course

Bloom's Taxonomy Level		T1	T2	ESE	Total
1	Remember				
2	Understand		10	40	50
3	Apply	20	10	20	50
4	Analyze				
5	Evaluate				
6	Create				
Total		**20**	**20**	**60**	**100**

Walchand College of Engineering, Sangli

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AY 2021-22

Course Information					
Programme		B.Tech.			
Class, Semester		First Year B.Tech., Sem I &II			
Course Code					
Course Name		Arduino Based Systems			
Desired Requisites:		No pre-requisite course.			
Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	2 Hrs/week	**T1**	**T2**	**ESE**	**Total**
Tutorial	-	20	20	60	100
Practical	-				
Interaction	-	**Credits: 2**			

Course Objectives	
1	To explain and illustrate the fundamentals of digital systems and op-amps which are necessary for Arduino based simple systems.
2	To explain, demonstrate the Arduino programming language and IDE
3	To illustrate and demonstrate programing for basic Arduino systems.
4	To illustrate how to build the prototype circuits and connect them to the Arduino for building useful systems.

Course Outcomes (CO) with Bloom's Taxonomy Level		
CO1	Explain fundamentals of digital systems and operational amplifiers	Understand
CO2	Illustrate the fundamentals of Arduino, installation of Arduino IDE, Running the arduino executable file, Using IDE to prepare Arduino sketch	Understand
CO3	Writing programs for interfacing various sensors and output devices with Arduino	Apply
CO4	Illustrate use of Arduino for an application or a system	Analyze

Module	**Course Contents**	**Hours**
I	**Overview of Digital Systems:-**Combinational Circuits- Adder, Subtractor, Multiplexer, Demultiplexer / Decoder, Sequential CircuitsFlip flops: S-R, D, Clocked flipflop, J-K Flip flop, Counters: Synchronous and Asynchronous, MOD –N Counters, Shift Registers, Memory Block	5
II	**Operational amplifiers:-**Block Diagram, Basic Operations, Op-Amps as comparator, Op amp in feedback mode, Inverting/ Noninverting Amplifier, Adder/ Subtractor	5
III	**Introduction to Arduino:-**Arduino device, Types of arduino, Features of Arduino, Components of Arduino board, Description of Microcontrollers, Installation of Arduino, Run the arduino executable file, Using IDE to prepare Arduino sketch, Uploading and running the sketch, Program notation: variables, functions, control flow, Arduino conventions. The concept of a program variable. Numerical values and basic numerical operators. If/then/else iteration using for loops. Real world timing and the delay() function	5
IV	**Input/Output Programming:-**Sensor Inputs: - Definition, Types. Interfacing arduino to different sensors- light sensor, temperature sensor, sound sensor, distance ranging sensor, water/detector sensor, smoke, gas, alcohol sensor, ultrasonic sensor Displays: Basics of LED's and LCD's. Interfacing arduino to LED's- blinking single LED, blinking multiple LED's, 7 segment display, LED dot matrix. Interfacing to LCD's- 16x2 LCD display	4
V	**Input/Output Programming:-**Motor control: DC motors- Speed control, spin direction control. Servo motor control, Steppers and Robots, Communication over Ethernet: Ethernet shield, internet weather, display, e-mail alert system, Arduino Libraries Using ESP 8266 – Logging data on online server using ThingSpeak	4
VI	**Arduino Applications:-**Case studies : Arduino based robot car, Arduino based PLC industrial application	3

Text Books	
1	"Arduino Cookbook", Michael Margolis, O'Reilly Publications, 2020
References	
1	"Beginning Arduino", Michal Mc Roberts, Second Edition, Apress Publishing, 2013
2	"Getting started with Arduino", Massimo Banzi, 2nd Edition, O'Reilly, 2011
Useful Links	
1	
2	
3	

CO-PO Mapping For All B.Tech. Programs

	Programme Outcomes (PO)												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3														
CO2		3													
CO3			2												
CO4		2													

The strength of mapping is to be written as 1,2,3; Where, 1:Low, 2:Medium, 3:High

Assessment (for Theory Course)

The assessment is based on 2 in-semester examinations in the form of T1 (Test-1) and T2 (Test-2) of 20 marks each. Also there shall be 1 End-Sem examination (ESE) of 60 marks. T1 shall be typically on modules 1 and 2, T2 based typically on modules 3, 4 and ESE shall be on all modules with nearly 50% weightage on modules 1 to 4 and 50% weightage on modules 5, 6.

Assessment Plan based on Bloom's Taxonomy Level (Marks) For Theory Course

Bloom's Taxonomy Level		T1	T2	ESE	Total
1	Remember				
2	Understand	10	10	20	**40**
3	Apply	10	10	20	40
4	Analyze			20	20
5	Evaluate				
6	Create				
Total		**20**	**20**	**60**	**100**

Walchand College of Engineering, Sangli

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AY 2021-22

Course Information					
Programme		B.Tech.			
Class, Semester		First Year B.Tech., Sem I &II			
Course Code					
Course Name		Life Science (Elective)			
Desired Requisites:		-Nil-			
Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	2 Hrs/week	**T1**	**T2**	**ESE**	**Total**
Tutorial	-	20	20	60	100
Practical	-				
Interaction	-	**Credits: 2**			

Course Objectives	
1	Introduce students to modern aspect of life science.
2	Develop an understanding of 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 and education in life science technologies.

Course Outcomes (CO) with Bloom's Taxonomy Level		
CO1	Outline and describe cytological, biochemical, physiological and genetic aspects of the cell,	Understanding
CO2	Explain the structure and function of organ systems in the human body and describe the concept, practice and significance of immunity.	Understanding
CO3	Relate knowledge of Bio chemistry, Biotechnology and Bioinformatics with application areas in Engineering.	Understanding

Module	**Course Contents**	**Hours**
I	**Cell Biology :** **Introduction to Cell structure and functions** Structure and function of prokaryotic cell (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.	3
II	**Bio Chemistry :** **Introduction to 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.	4
III	**Human Physiology:** **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,	9

	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.	
IV	**Immunity:** **Introduction, definition and types of Immunities and Antigens**, **Immunoglobulins**: 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.	4
V	**Biotechnology and Its Applications:** **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**: Indoleacetic acid, interferons. Methods of gene transfer in plants, crop improvement. **Introduction to transgenics**: Gene therapy, Genetically modified organisms Biosafety issues– Bio piracy.	4
VI	**Bioinformatics and its Applications:** Introduction and Definition of Bioinformatics, **Molecular Bioinformatics**: 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**.**	4

Text Books	
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.
References	
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.
Useful Links	
1	https://www.youtube.com/watch?v=yaQhH9iKY0M
2	https://www.youtube.com/watch?v=V6s0xOTNmT4
3	https://www.youtube.com/watch?v=5Q9LgvQs5Nw
4	https://www.youtube.com/watch?v=nzJXq4YMPYE
5	https://www.youtube.com/watch?v=ssIBNVLSG58
1	https://www.youtube.com/watch?v=yaQhH9iKY0M

CO-PO Mapping For All B.Tech. Programs

	Programme Outcomes (PO)												**PSO**		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1						**1**	**1**								
CO2							**1**	**1**							
CO3							**1**								

The strength of mapping is to be written as 1,2,3; Where, 1:Low, 2:Medium, 3:High

Walchand College of Engineering, Sangli

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AY 2021-22

Course Information					
Programme		B.Tech.			
Class, Semester		First Year B.Tech., Sem I &II			
Course Code					
Course Name		Engineering Graphics and AutoCAD Lab			
Desired Requisites:		Basic Knowledge of Computer			
Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	-	**LA1**	**LA2**	**Lab ESE**	**Total**
Tutorial	-	30	30	40	100
Practical	2 Hrs/week				
Interaction	-	**Credits: 1**			

Course Objectives	
1	To impart the techniques of engineering graphics using the CAD software
2	To prepare the students for applying knowledge of engineering graphics in real life drawings using CAD software
3	To develop the skills of students for evaluating CAD software for its applications

Course Outcomes (CO) with Bloom's Taxonomy Level		
CO1	Understand the basic principle of Engineering graphics and working of CAD software.	Understanding
CO2	Draw different views of components using the CAD software.	Applying
CO3	Apply the knowledge of engineering graphics in real life applications.	Applying

List of Experiments / Lab Activities.	
1	Plane Curves and Conic Sections (Min. 5 Problems)
2	Projections of Points and Lines (Min. 5 Problems)
3	Projections of Planes and Solids (Min. 6 Problems)
4	Development of Lateral Surfaces (Min. 3 Problems)
5	Orthographic Projections (Min. 2 Problems)
6	Isometric Projections (Min. 2 Problems)

Text Books	
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

Useful Links	
1	https://nptel.ac.in/courses/112/103/112103019/
2	https://nptel.ac.in/courses/105/104/105104148/
3	https://www.youtube.com/watch?v=xXdpkQXDuMw&list=PL9RcWoqXmzaJT-fliqTSwUjWU4zCX_H2A

CO-PO Mapping For All B.Tech. Programs															
	Programme Outcomes (PO)												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3				2					1		1	2		
CO2			2												
CO3					3					1					
The strength of mapping is to be written as 1,2,3; Where, 1:Low, 2:Medium, 3:High															

Assessment (for Lab. Course)

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

Bloom's Taxonomy Level	LA1	LA2	Lab ESE	Total
Remember				
Understand	10	10	10	**30**
Apply	15	15	20	**50**
Analyze	5	5	10	**20**
Evaluate				
Create				
Total	**30**	**30**	**40**	**100**

Walchand College of Engineering, Sangli

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AY 2021-22

Course Information

Programme	B.Tech.
Class, Semester	First Year B.Tech., Sem I &II
Course Code	
Course Name	Basic Electrical Engineering Lab
Desired Requisites:	

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	-	**LA1**	**LA2**	**Lab ESE**	**Total**
Tutorial	-	30	30	40	100
Practical	2 Hrs/week				
Interaction	-	**Credits: 1**			

Course Objectives

1	To demonstrate basic knowledge of Electrical engineering.
2	To develop skills to recognize working principle, construction and types of electrical machines.

Course Outcomes (CO) with Bloom's Taxonomy Level

CO1	**Describe** basic concepts of electrical circuits and various theorems.	**Remember**
CO2	**Demonstrate** the use of transformers and AC/DC machines.	**Apply**

List of Experiments / Lab Activities.

1	To study AC and DC machines parts and their functions.
2	To study series-parallel RL, RC and RLC circuits
3	To verify KVL and KCL theorems.
4	Study of AC/DC motor starters
5	To study speed control techniques of ac and dc machines
6	To perform load test on transformer.
7	To study servo motor/ steeper motor with application
8	Study of installation techniques using fuse, MCB and MCCB.

Text Books

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. N. Mittle and Arvind Mittal, "*Basic Electrical Engineering*", 2nd edition, Tata McGraw Hill.

Useful Links

1	https://nptel.ac.in/courses/108/105/108105053/

CO-PO Mapping For All B.Tech. Programs

	Programme Outcomes (PO)												**PSO**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3														
CO2	3								2						

The strength of mapping is to be written as 1,2,3; Where, 1:Low, 2:Medium, 3:High

Assessment (for Lab. Course)				
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				
Bloom's Taxonomy Level	**LA1**	**LA2**	**Lab ESE**	**Total**
Remember	25	15	10	**50**
Understand				
Apply	5	15	30	**50**
Analyze				
Evaluate				
Create				
Total	**30**	**30**	**40**	**100**

Walchand College of Engineering, Sangli

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AY 2021-22

Course Information					
Programme		B.Tech.			
Class, Semester		First Year B.Tech., Sem I &II			
Course Code					
Course Name		Engineering Chemistry Lab.			
Desired Requisites:		Chemistry course at secondary and higher secondary level			
Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	-	**LA1**	**LA2**	**Lab ESE**	**Total**
Tutorial	-	30	30	40	100
Practical	2 Hrs/week				
Interaction	-	**Credits: 1**			

Course Objectives		
1	To make the student familiar with analytical techniques.	
2	To provide hands on practice of titrimetric analysis.	
Course Outcomes (CO) with Bloom's Taxonomy Level		
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.	Applying
List of Experiments / Lab Activities.		
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 BaSO4 as BaO.	
Text Books		
1	College Practical Chemistry, V K Ahaluwaliya.Sunita Dhingra,Adarsha Gulati, Universities Press.	
2	Laboratory Manual on Engineering Chemistry by Sudha Rani And S.K. Bashin, Dhanpat Rai & Co.	
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.	
Useful Links		
1	https://www.lccc.edu/academics/science-and-engineering/science-in-motion/labs-equipment/chemistry-lab-experiments	
2	https://edu.rsc.org/resources/collections/classic-chemistry-experiments	

CO-PO Mapping For All B.Tech. Programs															
	Programme Outcomes (PO)												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	1	1													
The strength of mapping is to be written as 1,2,3; Where, 1:Low, 2:Medium, 3:High															

Assessment (for Lab. Course)

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

Bloom's Taxonomy Level	LA1	LA2	Lab ESE	Total
Remember	10	10	15	**35**
Understand	10	10	10	**30**
Apply	10	10	15	**35**
Analyze	0	0	0	**0**
Evaluate	0	0	0	**0**
Create	0	0	0	**0**
Total	**30**	**30**	**40**	**100**

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Course Information					
Programme	B.Tech.				
Class, Semester	First Year B.Tech., Sem I &II				
Course Code					
Course Name	Arduino Based Systems Lab				
Desired Requisites:	-				
Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	-	**LA1**	**LA2**	**Lab ESE**	**Total**
Tutorial	-	30	30	40	100
Practical	2 Hrs/week				
Interaction	-	**Credits: 1**			

Course Objectives	
1	To demonstrate and facilitate students to learn the fundamentals of digital systems and op-amps which are necessary for Arduino based simple systems.
2	To explain, demonstrate the Arduino programming language and IDE
3	To illustrate and demonstrate programing for basic Arduino systems
4	To illustrate and facilitate to build the prototype circuits and connect them to the Arduino for building useful systems.

Course Outcomes (CO) with Bloom's Taxonomy Level		
CO1	Install Arduino IDE, Run the arduino executable file, Using IDE to prepare Arduino sketch.	Apply
CO2	Interface various sensors with Arduino	Analyze
CO3	Use Arduino to build specific application/system.	Evaluate

List of Experiments / Lab Activities.	
1	Writing a program to blink the onboard LED
2	Arduino interfacing with Tricolor LED and Push button
3	Sensing analog voltage using onboard ADC and printing it on serial monitor
4	Using Arduino to generate Pulse width modulation output
5	Arduino-based servo motor control
6	Interfacing of ultrasonic distance sensor(HC-SR04) with Ardiuno
7	Ethernet and WiFi Connectivity with Arduino
8	Arduino interfacing with Tricolor LCD

Text Books	
1	"Arduino Cookbook", Michael Margolis, O'Reilly Publications, 2020

References	
1	"Beginning Arduino", Michal Mc Roberts, Second Edition, Apress Publishing, 2013
2	"Getting started with Arduino", Massimo Banzi, 2nd Edition, O'Reilly, 2011

Useful Links

CO-PO Mapping For All B.Tech. Programs

	Programme Outcomes (PO)												**PSO**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3														
CO2		3													
CO3				2											

The strength of mapping is to be written as 1,2,3; Where, 1:Low, 2:Medium, 3:High

Assessment (for Lab. Course)				
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				
Bloom's Taxonomy Level	**LA1**	**LA2**	**Lab ESE**	**Total**
Remember				
Understand				
Apply	20	15	20	**55**
Analyze	10	10	10	**30**
Evaluate		5	10	**15**
Create				
Total	**30**	**30**	**40**	**100**

GROUP A SEM-I

Course Name	Theory Hrs.	Tutorial HRs	LAB. Hrs.	Credits	Category
Engineering Physics	3	--	--	3	BS
Engineering Mathematics- I	3	1	--	4	BS
Engineering Mechanics	3	--	--	3	ES
Communication Skills	2	1	--	3	HS
Programming For Problem Solving	2	--	--	2	BS
Engineering Mechanics Lab.	--	--	2	1	ES
Workshop Practice	--	--	2	1	ES
Programming For Problem Solving Lab.	--	--	2	1	ES
Physics Lab.	--	--	2	1	BS
TOTAL	**13**	**2**	**8**	**19**	

GROUP A SEM-II

Course Name	Theory Hrs.	Tutorial HRs	LAB. Hrs.	Credits	Category
Engineering Chemistry	3	--	--	3	BS
Engineering Mathematics- II	3	1	--	4	BS
Engineering Graphics and AutoCAD	2	--	--	2	ES
Basic Electrical Engineering	3	--	--	3	ES
Arduino Based System	2	--	--	2	ES
Life Science	2	--	--	2	HS
Engineering Graphics and AutoCAD Lab.	--	--	2	1	ES
Basic Electrical Engineering Lab.	--	--	2	1	ES
Chemistry Lab.	--	--	2	1	BS
Arduino Based System Lab.	--	--	2	1	ES
TOTAL	**15**	**1**	**8**	**20**	

GROUP B SEM-I

Course Name	Theory Hrs.	Tutorial HRs	LAB. Hrs.	Credits	Category
Engineering Chemistry	3	--	--	3	BS
Engineering Mathematics- I	3	1	--	4	BS
Engineering Graphics and AutoCAD	2	--	--	2	ES
Basic Electrical Engineering	3	--	--	3	ES
Arduino Based System	2	--	--	2	ES
Life Science	2	--	--	2	HS
Engineering Graphics and AutoCAD Lab.	--	--	2	1	ES
Basic Electrical Engineering Lab.	--	--	2	1	ES
Chemistry Lab.	--	--	2	1	BS
Arduino Based System Lab.	--	--	2	1	ES
TOTAL	**15**	**1**	**8**	**20**	

GROUP B SEM-II

Course Name	Theory Hrs.	Tutorial HRs	LAB. Hrs.	Credits	Category
Engineering Physics	3	--	--	3	BS
Engineering Mathematics- II	3	1	--	4	BS
Engineering Mechanics	3	--	--	3	ES
Communication Skills	2	1	--	3	HS
Programming For Problem Solving	2	--	--	2	BS
Engineering Mechanics Lab.	--	--	2	1	ES
Workshop Practice	--	--	2	1	ES
Programming For Problem Solving Lab.	--	--	2	1	ES
Physics Lab.	--	--	2	1	BS
TOTAL	**13**	**2**	**8**	**19**	

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Course Information	
Programme	B.Tech. (Computer Science and Engineering)
Class, Semester	Second Year B. Tech., Sem III
Course Code	
Course Name	Probability and Statistics
Desired Requisites:	Mathematics course at Higher Secondary Junior College

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	Hrs/week	**T1**	**T2**	**ESE**	**Total**
Tutorial	2Hrs/Week	20	20	60	100
Practical	-				
Interaction	-	**Credits: 02**			

Course Objectives	
1	Familiarize the students with techniques in probability and statistics.
2	Design a statistical hypothesis about the real world problem and conduct appropriate test for drawing valid inference about the population characteristics.

Course Outcomes (CO) with Bloom's Taxonomy Level		
CO1	**Apply** computational tools to solve Mathematical and Statistical problems	Apply
CO2	**Solve** problems in probability, statistics.	Apply

Module	**Module Contents**	**Hours**
I	**Random Variable** Discrete random variable, Continuous random variable, Probability mass function, cumulative distribution function, Bivariate discrete random variable, Joint probability distribution Joint distribution function of two dimensional discrete random variable.	4
II	**Probability Distribution** Gaussian Distribution, Exponential Distribution, Uniform Distribution	4
III	**Statistical Methods** Measure of central tendency , measure of dispersion , range, Quartile deviation , mean deviation , Variance, Standard deviation, coefficient of variance, Moments, Symmetry, Skewness , Kurtosis and types of kurtosis	5
IV	**Population and Sample** Introduction, Types of Characteristics: Attributes and Variables, Collection and Organization of data, Population and sample, Methods of Sampling.	3
V	**Exact Sampling Distribution** Chi-square distribution: Definitions and its properties, Student t-distribution: Definitions and its properties.	4

VI	**Testing of Hypothesis** Random samples , Parameter, statistic, standard error of Statistic, null and alternative hypothesis, critical region, level of significance, Types of error, large sample test, small sample test	7
Text Books		
1	Gupta and Kapoor, “Fundamentals of Mathematical Statistics”.	
2	Vijay Rohatgi, “An Introduction to Probability and Statistics”.	
References		
1	Sheldon M. Ross, “Introduction to Probability and Statistics for Engineers and Scientists”, Academic Press, (2009)	
Useful Links		
1	https://www.youtube.com/watch?v=aKohB8lPueg	

CO-PO Mapping															
	Programme Outcomes (PO)												**PSO**		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	1													
CO2	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
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	20	20	60	100
4	Analyze				
5	Evaluate				
6	Create				
Total		**20**	**20**	**60**	**100**

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Course Information	
Programme	B.Tech. (Computer Science and Engineering)
Class, Semester	Second Year B. Tech., Sem III
Course Code	
Course Name	Discrete Mathematics
Desired Requisites:	Mathematics-(set theory, Boolean operations, logical operations)

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	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.
3	To give deep insight into discrete probability and combinatorics

Course Outcomes (CO) with Bloom's Taxonomy Level		
At the end of the course, the students will be able to,		
CO1	Explain logical notation to define and reason about fundamental mathematical concepts of logic theory, set theory, relations, probability, counting techniques.	Understanding
CO2	Demonstrate knowledge and skills obtained to investigate and solve problems of POSET, Hasse diagram, groups, semi group and monoid	Applying
CO3	Analyse concepts and algorithms of graph theory and elementary combinatorial processes such as permutations and combinations.	Analysing

Module	**Module Contents**	**Hours**
I	**Mathematical Logic & Set Theory** 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.	6
II	**Relations and Functions** 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	7
III	**Algebraic structures** Introduction, Operations, semigroups, Groups, subgroups, Rings, monoid.	6

IV	**Graph theory and its applications** 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.	7
V	**Directed graphs** 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..	6
VI	**Permutation, Combination and Discrete Probabilities** 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.	7

Text Books	
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

Useful Links	
1	DM course on Udemy: Link
2	Course on NPTEL:Link

CO-PO Mapping

	Programme Outcomes (PO)												**PSO**		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	
CO1	3	2											1		
CO2	3	2											1		
CO3	2												1		

1:Low, 2:Medium, 3:High

Assessment (for Theory Course)

The assessment is based on 2 in-semester examinations in the form of T1 (Test-1) and T2 (Test-2) of 20 marks each. Also there shall be 1 End-Sem examination (ESE) of 60 marks. T1 shall be typically on modules 1 and 2, T2 based typically on modules 3, 4 and ESE shall be on all modules with nearly 50% weightage on modules 1 to 4 and 50% weightage on modules 5, 6.

Assessment Plan based on Bloom's Taxonomy Level (Marks) For Theory Course

Bloom's Taxonomy Level	**T1**	**T2**	**ESE**	**Total**

1	Remember				
2	Understand	10	5	15	30
3	Apply	10	10	20	40
4	Analyze		5	25	30
5	Evaluate				
6	Create				
Total		**20**	**20**	**60**	**100**

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Course Information

Programme	B.Tech. (Computer Science and Engineering)
Class, Semester	Second Year B. Tech., Sem III
Course Code	
Course Name	Data Structures
Desired Requisites:	Programming in C including pointers and File Handling

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 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 Outcomes (CO) with Bloom's Taxonomy Level

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	Understand
CO2	Choose suitable data structure to be used and apply it to solve the various problems	Apply
CO3	Compare and Analyze various algorithms, searching and sorting methods based on inherent properties of data structures and the complexity of algorithms.	Analyze

Module	Module Contents	Hours
I	**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	6
II	**Linked Lists** 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.	6
III	**Stacks and Queues** 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.	6
IV	**Trees** 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.	7
V	**Graphs** Terminology and Representation of graphs using adjacency matrix, adjacency list and adjacency Multilist, Traversals Depth First and Breadth First, Minimum Spanning Tree.	5
VI	**Searching & Sorting Technique** **Searching:** 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	9
Text Books		
1	Richard F. Gilberg, Behrouz A. Forouzan, "Data Structures, A Pseudocode Approach With C",Cengage Learning, Second Edition, 2014	
2	S. Lipschutz, "Data Structures,Schaum's" Outlines Series, Tata McGraw-Hill, 2013	
3	Ellis Horowitz, S. Sahni, D. Mehta, "Fundamentals of Data Structures in C++", Galgotia Book Source, New Delhi, 2008	
References		
1	Yashavant Kanetkar, "Understanding pointers in C", BPB Publication, 4th Edition, 2009	
2	N. B. Venkateshwarlu, E. V. Prasad, "C and Data Structures", S. Chand and Company, 2010	
3	Jean-Paul Tremblay, Paul. G. Soresan, "An introduction to data structures with Applications", Tata Mc-Graw Hill International Editions, 2nd edition, 1984	

Useful Links	
1	http://www.nptelvideos.in/2012/11/data-structures-and-algorithms.html
2	https://www.coursera.org/learn/data-structures
3	http://vlabs.iitb.ac.in/vlabs-dev/labs/mit_bootcamp/dslab/index.php
4	https://nptel.ac.in/courses/106/106/106106130/

CO-PO Mapping															
	Programme Outcomes (PO)												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	
CO1	2														
CO2	3	3	2										3		
CO3	3	3	2										3		
The strength of mapping is to be written as 1,2,3; Where, 1:Low, 2:Medium, 3:High Each CO of the course must map to at least one PO.															

Assessment (for Theory Course)
The assessment is based on 2 in-semester examinations in the form of T1 (Test-1) and T2 (Test-2) of 20 marks each. Also there shall be 1 End-Sem examination (ESE) of 60 marks. T1 shall be typically on modules 1 and 2, T2 based typically on modules 3, 4 and ESE shall be on all modules with nearly 50% weightage on modules 1 to 4 and 50% weightage on modules 5, 6.

Assessment Plan based on Bloom's Taxonomy Level (Marks) For Theory Course					
Bloom's Taxonomy Level		**T1**	**T2**	**ESE**	**Total**
1	Remember				
2	Understand	15	15	30	60
3	Apply	5	5	20	30
4	Analyze			10	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	Second Year B. Tech., Sem III
Course Code	
Course Name	Data Communication
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 elaborate various features and operations of data communication.
2	To inculcate protocol functions and issues related to the Data Link layer.
3	To introduce the design and configuration of various networking techniques.

Course Outcomes (CO) with Bloom's Taxonomy Level

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

CO1	Describe fundamental concepts of data communication system	Understand
CO2	Interpret various concepts related to data link layer protocols	Apply
CO3	Differentiate and analyze various data communication techniques	Analyze

Module	**Module Contents**	**Hours**
I	**Introduction** 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.	4
II	**Encoding techniques** 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.	8
III	**Multiplexing** 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.	8
IV	**Switching techniques**	8

	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.	
V	**Congestion control** 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.	5
VI	**Flow Control and Internet Reference Models** 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.	6

Text Books	
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

Useful Links	
1	https://nptel.ac.in/courses/106/105/106105082/

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	1	2	-	-	-	-	-	-	-	-	-	-	1	-
CO3	-	-	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	7	7	20	34
3	Apply	7	7	20	34
4	Analyze	6	6	20	32
5	Evaluate				
6	Create				
Total		**20**	**20**	**60**	**100**

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Course Information	
Programme	B.Tech. (Computer Science and Engineering)
Class, Semester	Second Year B. Tech., Sem III
Course Code	
Course Name	Computer Organization and Architecture
Desired Requisites:	Basic Electronics 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 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 Outcomes (CO) with Bloom's Taxonomy Level		
At the end of the course, the students will be able to,		
CO1	Describe basic concepts of the organization and architecture of computer and interfacing with external devices.	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.	Applying
CO3	Analyze the working of processors like 8085,8086,ARM and interfacing of external devices like memory and I/O.	Analyzing

Module	Module Contents	Hours
I	**Introduction to Computer Organization** 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.	6
II	**Data Representation and Computer Arithmetic** The Arithmetic and Logic Unit, Integer Representation, Integer Arithmetic, Floating-Point Representation, Floating-Point Arithmetic, Programmable Logic Devices.	6
III	**8085 Microprocessor** 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.	8
IV	**X-86 microprocessor Family** 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.	7
V	**Interfacing of Memory & Input / Output Devices** 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.	7
VI	**Introduction to ARM Processor** 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.	7

Text Books

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, 1st edition, 2012
Useful Links	
1	ARM Based Development course, NPTEL(https://nptel.ac.in/courses/117106111/)

CO-PO Mapping														
	Programme Outcomes (PO)												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	1											2	
CO2	2	2	2										3	
CO3	3	2	2										3	
The strength of mapping is to be written as 1,2,3; Where, 1:Low, 2:Medium, 3:High Each CO of the course must map to at least one PO.														

Assessment (for Theory Course)
The assessment is based on 2 in-semester examinations in the form of T1 (Test-1) and T2 (Test-2) of 20 marks each. Also there shall be 1 End-Sem examination (ESE) of 60 marks. T1 shall be typically on modules 1 and 2, T2 based typically on modules 3, 4 and ESE shall be on all modules with nearly 50% weightage on modules 1 to 4 and 50% weightage on modules 5, 6.

Assessment Plan based on Bloom's Taxonomy Level (Marks) For Theory Course					
Bloom's Taxonomy Level		**T1**	**T2**	**ESE**	**Total**
1	Remember				
2	Understand	10	10	10	30
3	Apply	10	10	20	40
4	Analyze			30	30
5	Evaluate				
6	Create				
Total		**20**	**20**	**60**	**100**

Walchand College of Engineering, Sangli

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Course Information	
Programme	B.Tech. (Computer Science and Engineering)
Class, Semester	Second Year B. Tech., Sem III
Course Code	
Course Name	Software Engineering
Desired Requisites:	

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

Course Objectives	
1	To 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 Outcomes (CO) with Bloom's Taxonomy Level		
At the end of the course, the students will be able to,		
CO1	Grasp industry processes on software development to become IT industry-savvy.	Understand
CO2	Prepare with the spirit of team-working and importance of using artifacts at SDLC phases.	Apply
CO3	Distinguish and evaluate procedural & OO based development practices.	Analyze
CO4	Integrate expertise on CASE tools usage especially for design and testing of software to undertake industrial strength software projects.	Create

Module	**Module Contents**	**Hours**
I	**Software Processes** Need of software engineering approach, ETVX model, project management process, software development process & models, configuration management process, process management process.	6
II	**Software Quality & Project Planning** Quality objectives, software quality factors, PAF Model, quality standards, project management plan, cost estimation, project scheduling, personnel planning with WBS, risk management.	6
III	**Software Requirement Analysis & Function Oriented Design** Software requirement process, need and characteristics of SRS artifact, design principles, module level concepts, design notation and specifications, structured design methodology.	7
IV	**Object Oriented Design with UML & Continual Integration**	8

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

Text Books	
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.

Useful Links	
1	https://nptel.ac.in/courses/106/105/106105182/
2	https://www.javatpoint.com/software-engineering-tutorial

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	3		
CO2			1	2				3	3	3					
CO3					2										
CO4			2									2		3	

The strength of mapping is to be written as 1,2,3; Where, 1:Low, 2:Medium, 3:High
Each CO of the course must map to at least one PO.

Assessment (for Theory Course)

The assessment is based on 2 in-semester examinations in the form of T1 (Test-1) and T2 (Test-2) of 20 marks each. Also there shall be 1 End-Sem examination (ESE) of 60 marks. T1 shall be typically on modules 1 and 2, T2 based typically on modules 3, 4 and ESE shall be on all modules with nearly 50% weightage on modules 1 to 4 and 50% weightage on modules 5, 6.

Assessment Plan based on Bloom's Taxonomy Level (Marks) For Theory Course

Bloom's Taxonomy Level	**T1**	**T2**	**ESE**	**Total**

1	Remember				
2	Understand	15	10	20	45
3	Apply	5	5	20	30
4	Analyze		5	15	20
5	Evaluate				
6	Create			5	05
Total		**20**	**20**	**60**	**100**

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Course Information

Programme	B.Tech. (Computer Science and Engineering)
Class, Semester	Second Year B. Tech., Sem III
Course Code	
Course Name	Programming Lab 1
Desired Requisites:	Introduction to any Programming Language

Teaching Scheme (Hrs)		**Examination Scheme (Marks)**			
Lecture	-	**LA1**	**LA2**	**ESE**	**Total**
Tutorial	-	30	30	40	100
Practical	2				
Interaction	-	**Credits: 1**			

Course Objectives

1	To 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 Outcomes (CO) with Bloom's Taxonomy Level

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

CO1	Explain the features of object oriented programming using C++ and Python.	Understand
CO2	Demonstrate the solution to real world problems using C++ and Python.	Apply

List of Experiments / Lab Activities

List of Experiments:

1. Program based on creating Class and Object.
2. Program based on constructor and destructor.
3. Implementation of Inheritance and polymorphism.
4. Programs on files.
5. Programs based on use of template, generic template and function.
6. Programs based on namespaces.
7. Program based on expression, data type, functions.
8. Programs based on implementation of loops, strings, lists and dictionaries.
9. Programs based on Graphical user interface design using python.
10. Programs related to Multi-threading, Exception handling, file handling.

Text Books	
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

Useful Links	
1	https://onlinecourses.nptel.ac.in/noc21_cs32/announcements?force=true
2	https://www.javatpoint.com/cpp-tutorial
3	https://www.w3schools.com/python/

CO-PO Mapping

	Programme Outcomes (PO)												**PSO**		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1													1		
CO2					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	10	10	15	**35**
Apply	20	20	25	**65**
Analyze				
Evaluate				
Create				
Total Marks	**30**	**30**	**40**	**100**

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Course Information

Programme	B.Tech. (Computer Science and Engineering)
Class, Semester	Second Year B. Tech., Sem III
Course Code	
Course Name	Data Structures Lab
Desired Requisites:	Programming in C including pointers and File Handling

Teaching Scheme (Hrs)		**Examination Scheme (Marks)**			
Lecture	-	**LA1**	**LA2**	**ESE**	**Total**
Tutorial	-	30	30	40	100
Practical	2				
Interaction	-	**Credits: 1**			

Course Objectives

1	To 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 Outcomes (CO) with Bloom's Taxonomy Level		
CO1	Demonstrate the concept of recursion, abstract properties of various linear and nonlinear data structures, searching and sorting methods through implementation.	Apply
CO2	Identify suitable data structure to be used to solve the various problems.	Analyze
CO3	Select appropriate searching, sorting method on the basis of its performance while developing application.	Evaluate

List of Experiments / Lab Activities

List of Experiments:

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

Text Books

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

Useful Links

1	http://www.nptelvideos.in/2012/11/data-structures-and-algorithms.html
2	https://www.coursera.org/learn/data-structures

3	http://vlabs.iitb.ac.in/vlabs-dev/labs/mit_bootcamp/dslab/index.php
4	https://nptel.ac.in/courses/106/106/106106130/

CO-PO Mapping															
	Programme Outcomes (PO)												**PSO**		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	
CO1					2										
CO2				3	2								3		
CO3				3	2								3		
The strength of mapping is to be written as 1,2,3; Where, 1:Low, 2:Medium, 3:High Each CO of the course must map to at least one PO.															

Assessment				
There are three components of lab assessment, LA1, LA2 and Lab ESE. IMP: Lab ESE is a separate head of passing. LA1, LA2 together is treated as In-Semester Evaluation.				
Assessment	**Based on**	**Conducted by**	**Typical Schedule (for 26-week Sem)**	**Marks**
LA1	Lab activities, attendance, journal	Lab Course Faculty	During Week 1 to Week 6 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	20	20	**60**
Analyze	10	10	10	**30**
Evaluate			10	**10**
Create				
Total Marks	**30**	**30**	**40**	**100**

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Course Information	
Programme	B.Tech. (Computer Science and Engineering)
Class, Semester	Second Year B. Tech., Sem IV
Course Code	
Course Name	Computer Organization And Architecture Laboratory
Desired Requisites:	Programming by using assembly language

Teaching Scheme (Hrs)		**Examination Scheme (Marks)**			
Lecture	-	**LA1**	**LA2**	**ESE**	**Total**
Tutorial	-	30	30	40	100
Practical	2				
Interaction	-	**Credits: 1**			

Course Objectives	
1	To 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 Outcomes (CO) with Bloom's Taxonomy Level		
At the end of the course, the students will be able to,		
CO1	Grasp the fundamentals of assembly level programming using microprocessor trainer kit and interfacing with other I/O devices.	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.	Applying

List of Experiments / Lab Activities

List of Experiments:

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.

Text Books	
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

Useful Links	
1	ARM Based Development course, NPTEL(https://nptel.ac.in/courses/117106111/)

CO-PO Mapping														
	Programme Outcomes (PO)												**PSO**	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2				3									
CO2			2	2	2									

The strength of mapping is to be written as 1,2,3; Where, 1:Low, 2:Medium, 3:High Each CO of the course must map to at least one PO.

Assessment				
There are three components of lab assessment, LA1, LA2 and Lab ESE. IMP: Lab ESE is a separate head of passing. LA1, LA2 together is treated as In-Semester Evaluation.				
Assessment	**Based on**	**Conducted by**	**Typical Schedule (for 26-week Sem)**	**Marks**
LA1	Lab activities, attendance, journal	Lab Course Faculty	During Week 1 to Week 6 Marks Submission at the end of Week 6	30
LA2	Lab activities, attendance, journal	Lab Course Faculty	During Week 7 to Week 12 Marks Submission at the end of Week 12	30
Lab ESE	Lab activities, attendance, journal	Lab Course Faculty	During Week 15 to Week 18 Marks Submission at the end of Week 18	40
Week 1 indicates starting week of a semester. The typical schedule of lab assessments is shown, considering a 26-week semester. The actual schedule shall be as per academic calendar. Lab activities/Lab performance shall include performing experiments, mini-project, presentations, drawings, programming and other suitable activities, as per the nature and requirement of the lab course. The experimental lab shall have typically 8-10 experiments.				

Assessment Plan based on Bloom's Taxonomy Level (Marks) (For lab Courses)				
Bloom's Taxonomy Level	**LA1**	**LA2**	**Lab ESE**	**Total**
Remember				
Understand	20	10	10	**40**
Apply	10	20	30	**60**
Analyze				
Evaluate				
Create				
Total Marks	**30**	**30**	**40**	**100**

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Course Information	
Programme	B.Tech. (Computer Science and Engineering)
Class, Semester	Second Year B. Tech., Sem IV
Course Code	
Course Name	Applied Mathematics for Computer Science and Engineering
Desired Requisites:	Engineering Mathematics I and Engineering Mathematics II

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 infuse an understanding of the mathematical theory of Linear Algebra, Evaluation metrics 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 set.

Course Outcomes (CO) with Bloom's Taxonomy Level		
CO1	**Illustrate** the concept of Linear Algebra and Fuzzy sets with case studies.	Understanding
CO2	**Apply** various evaluation metrics for result analysis	Applying
CO3	**Solve** mathematical problems using tools from mathematical areas, including algebra, analysis, evaluation metrics and number theory.	Applying

Module	**Module Contents**	**Hours**
I	**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
II	**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
III	**Fuzzy Sets** Introduction to characteristics functions, First decomposition theorem, Fuzzy relations, examples, Fuzzy equations, Operations on Fuzzy sets.	7
IV	**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

V	**Evaluation metrics** Intersection over union (IoU), Inception score, Frechet Inception distance, BLEU, METEROR, Rough, CIDER score, Confusion Matrix, F1 Score, Recall or Sensitivity, Gain and Lift Charts, Kolmogorov Smirnov Chart, AUC – ROC, Log Loss, Gini Coefficient, Concordant – Discordant Ratio, Root Mean Squared Error.	7
VI	**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

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

References	
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.

Useful Links	
1	https://www.khanacademy.org/math/statistics-probability

CO-PO Mapping

	Programme Outcomes (PO)												**PSO**		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	
CO2	**-**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**-**	
CO3	**2**	**-**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**	

The strength of mapping is to be written as 1,2,3; Where, 1:Low, 2:Medium, 3:High
Each CO of the course must map to at least one PO.

Assessment (for Theory Course)

The assessment is based on 2 in-semester examinations in the form of T1 (Test-1) and T2 (Test-2) of 20 marks each. Also there shall be 1 End-Sem examination (ESE) of 60 marks. T1 shall be typically on modules 1 and 2, T2 based typically on modules 3, 4 and ESE shall be on all modules with nearly 50% weightage on modules 1 to 4 and 50% weightage on modules 5, 6.

Assessment Plan based on Bloom's Taxonomy Level (Marks) For Theory Course

Bloom's Taxonomy Level		**T1**	**T2**	**ESE**	**Total**
1	Remember				
2	Understand	15	10	20	45
3	Apply	5	10	40	55
4	Analyze				

5	Evaluate				
6	Create				
Total		**20**	**20**	**60**	**100**

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Course Information

Programme	B.Tech. (Computer Science and Engineering)
Class, Semester	Second Year B. Tech., Sem IV
Course Code	
Course Name	Formal Language and Automata Theory
Desired Requisites:	Discrete Mathematics

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

Course Objectives

1	To 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 Outcomes (CO) with Bloom's Taxonomy Level

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

CO1	Explain the fundamental concepts related to string, language, grammar and their properties	Understanding
CO2	Examine and Construct different grammars, regular expressions and relate the languages defined by different grammars and regular expressions.	Applying
CO3	Design Finite Automata, PDA, Turing Machine to recognize different languages.	Creating

Module	**Module Contents**	**Hours**
I	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.	6
II	Deterministic finite automata definition and representation, Nondeterministic F.A., NFA with ^ transitions, Equivalence of DFAs, NFAs and NFA-^s. Kleene's theorem & proofs, minimum state FA for a regular language, minimizing number of states in an FA.	10
III	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.	6

IV	Definition, deterministic PDA, types of acceptance and conversions to each other, CFGs & PDAs, Top-Down, & Bottom-up parsing.	6
V	BNF, CNF and GNF notations, Eliminating ^ production and unit productions from a CFG, Eliminating useless variables from a Context Free Grammar.	4
VI	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.	7

Text Books	
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

Useful Links	
1	Introduction to Automata theory - YouTube
2	Mod-01 Lec-01 Introduction - YouTube

CO-PO Mapping															
	Programme Outcomes (PO)												**PSO**		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	3	-	2	-	-	-	-	-	-	-	-	3	-	-
CO3	3	3	-	2	-	-	-	-	-	-	-	-	3	-	-
The strength of mapping is to be written as 1,2,3; Where, 1:Low, 2:Medium, 3:High Each CO of the course must map to at least one PO.															

Assessment (for Theory Course)
The assessment is based on 2 in-semester examinations in the form of T1 (Test-1) and T2 (Test-2) of 20 marks each. Also there shall be 1 End-Sem examination (ESE) of 60 marks. T1 shall be typically on modules 1 and 2, T2 based typically on modules 3, 4 and ESE shall be on all modules with nearly 50% weightage on modules 1 to 4 and 50% weightage on modules 5, 6.

Assessment Plan based on Bloom's Taxonomy Level (Marks) For Theory Course					
Bloom's Taxonomy Level		**T1**	**T2**	**ESE**	**Total**
1	Remember				
2	Understand	10	10	30	50
3	Apply	10	5	20	35
4	Analyze				
5	Evaluate				

6	Create		5	10	15
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	Second Year B. Tech., Sem IV
Course Code	
Course Name	Operating Systems
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 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 Outcomes (CO) with Bloom's Taxonomy Level

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

CO1	Describe the primitive concepts of Operating System services and system software functionality.	Understand
CO2	Illustrate Process management, Memory management, Storage management and I/O management core techniques in effective execution of processes.	Apply
CO3	Assess various algorithms of Process, Memory, Storage & I/O management for performance and quality criterion.	Evaluate
CO4		

Module	**Module Contents**	**Hours**
I	**Overview of Operating System** 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	6
II	**System Softwares**	6

	Notions of editors, Macro processors, Compilers, Assemblers, loaders & linkers, Multiprogramming and time sharing.	
III	**Process Management** **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.	7
IV	**Process Coordination** **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.	7
V	**Memory Management** **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.	8
VI	**Storage Management** **File System :** File concept, access methods, directory and disk structure, file-system mounting, file sharing, protection.	5

Text Books	
1	Abraham Silberschatz, Peter Baer Galvin, Greg Gagne, "Operating System Concepts", John Wiley, 10th Edition, 2018
2	D. M. Dhamdhere,"Operating Systems A Concept-Based Approach", McGraw-Hill, 3rd edition, 2012

References	
1	Charles Crowley, "Operating System A Design Oriented Approach", McGraw-Hill Education Pvt. Ltd., 2001
2	Achyut S. Godbole, Atul Kahate "Operating System with Case Studies in Unix, Netware and Windows NT", Tata McGraw Hill,3rd edition, 2010
3	D.M.Dhamdhere, "System Programming and Operating Systems", Tata McGraw - Hill, 2nd Edition, 1999

Useful Links	
1	https://nptel.ac.in/courses/106/108/106108101/
2	https://www.javatpoint.com/os-tutorial

CO-PO Mapping															
	Programme Outcomes (PO)												**PSO**		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2														

CO2	3	2											2		
CO3	2	3											3		

The strength of mapping is to be written as 1,2,3; Where, 1:Low, 2:Medium, 3:High
Each CO of the course must map to at least one PO.

Assessment (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	20	40
3	Apply	10	5	20	35
4	Analyze				
5	Evaluate		5	20	25
6	Create				
Total		**20**	**20**	**60**	**100**

Walchand College of Engineering, Sangli

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AY 2021-22

Course Information	
Programme	B.Tech. (Computer Science and Engineering)
Class, Semester	Second Year B. Tech., Sem IV
Course Code	
Course Name	Database Engineering
Desired Requisites:	Data Structures

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 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 a physical and logical database designs, database modelling, 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 Outcomes (CO) with Bloom's Taxonomy Level		
At the end of the course, the students will be able to,		
CO1	Explain concepts of conceptual database design, redundancy problem, storage system, transaction processing, concurrency control and security in DBMS	Understanding
CO2	Apply theoretical knowledge to design ER diagram, prepare relational schema using appropriate constraints and normalization for a given specification of the requirement	Applying
CO3	Construct SQL queries for Open source and Commercial DBMS for a given specification schema to fetch essential data	Applying

Module	Module Contents	Hours
I	**Introduction and Database Modelling using ER Model** **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	6
II	**Relational Model and SQL** **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.	8
III	**Relational Database Design** 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	7
IV	**Data Storage and Indexing** 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.	6
V	**Transaction Processing and Concurrency Control** **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.	7

VI	**Database security and Recovery System** 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.	5

Text Books	
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", 3 rd Edition, 1999 / later
3	Bipin c. Desai "An Introduction to Database System", Galgotia Publications, 2nd revised edition

Useful Links	
1	https://www.geeksforgeeks.org/
2	https://nptel.ac.in/courses/106/105/106105175/

CO-PO Mapping

	Programme Outcomes (PO)												**PSO**		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	1														
CO2	1	2											1		
CO3			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	10	5	5	20
3	Apply	10	15	25	50
4	Analyze			30	30
5	Evaluate				
6	Create				
Total		**20**	**20**	**60**	**100**

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Course Information	
Programme	B.Tech. (Computer Science and Engineering)
Class, Semester	Second Year B. Tech., Sem IV
Course Code	
Course Name	Computer Network
Desired Requisites:	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 recall protocol functions and issues related to the 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 Outcomes (CO) with Bloom's Taxonomy Level		
At the end of the course, the students will be able to,		
CO1	Articulate networking basics and different layers in networking models	Understanding
CO2	Examine the features and operations of protocols of data Link Layer, Network layer, transport layer and Application Layer.	Applying
CO3	Categorize and compare networking protocols.	Analyzing

Module	**Module Contents**	**Hours**
I	**Networking Basics** Evolution of network, Introduction to Computer Networks, Types of Network, Physical & Logical Topology, and Introduction to different types of network, internetworking, Intranet, Internet and revisit to Reference models-OSI, TCP/IP.	4
II	**Data Link Layer** 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.	8
III	**The Network Layer** 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	7
IV	**The Transport Layer** Process-to-process delivery, user datagram protocol (UDP), TCP, SCTP, Socket Programming	7

V	**Congestion Control and Quality of Service** Congestion, congestion control, congestion control in TCP, introduction to queuing theory, quality of service, techniques to improve qos, integrated services, differentiated services	6
VI	**Application Layer** Domain Name Space (DNS), DDNS, TELNET, EMAIL, File Transfer Protocol (FTP), WWW, HTTP, SNMP	7

Text Books	
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

Useful Links	
1	Nptel Course: Link
2	Udemy Course: Link

CO-PO Mapping

	Programme Outcomes (PO)												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	
CO1	1														
CO2	1	2											1		
CO3			1												

1:Low, 2:Medium, 3:High

Assessment (for Theory Course)

The assessment is based on 2 in-semester examinations in the form of T1 (Test-1) and T2 (Test-2) of 20 marks each. Also there shall be 1 End-Sem examination (ESE) of 60 marks. T1 shall be typically on modules 1 and 2, T2 based typically on modules 3, 4 and ESE shall be on all modules with nearly 50% weightage on modules 1 to 4 and 50% weightage on modules 5, 6.

Assessment Plan based on Bloom's Taxonomy Level (Marks) For Theory Course

Bloom's Taxonomy Level		**T1**	**T2**	**ESE**	**Total**
1	Remember				
2	Understand	10	5	10	25
3	Apply	10	10	25	45
4	Analyze		5	25	30
5	Evaluate				
6	Create				
Total		**20**	**20**	**60**	**100**

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AY 2021-22

Course Information

Programme	B.Tech. (Computer Science and Engineering)
Class, Semester	Second Year B. Tech., Sem IV
Course Code	
Course Name	Database Engineering Lab
Desired Requisites:	Data Structures

Teaching Scheme (Hrs)		**Examination Scheme (Marks)**			
Lecture	-	**LA1**	**LA2**	**ESE**	**Total**
Tutorial	-	30	30	40	100
Practical	2				
Interaction	-	**Credits: 1**			

Course Objectives

1	To 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.
4	

Course Outcomes (CO) with Bloom's Taxonomy Level

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

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.	Apply
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.	Apply
CO3	Compare and use various ways of writing the queries for a given problem and extract required information from the database.	Analyze

List of Experiments / Lab Activities

List of Experiments:

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++

Text Books	
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", 3 rd Edition, 1999 / later
3	Bipin c. Desai "An Introduction to Database System", Galgotia Publications, 2nd revised edition
Useful Links	
1	https://www.geeksforgeeks.org/
2	https://nptel.ac.in/courses/106/105/106105175/

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	2	2								3		
CO2				2	3								3		
CO3				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	5		5	**10**
Apply	15	15	20	**50**
Analyze	10	15	15	**40**
Evaluate				
Create				
Total Marks	**30**	**30**	**40**	**100**

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Course Information

Programme	B.Tech. (Computer Science and Engineering)
Class, Semester	Second Year B. Tech., Sem IV
Course Code	
Course Name	Computer Network Lab
Desired Requisites:	Data Communication

Teaching Scheme (Hrs)		**Examination Scheme (Marks)**			
Lecture	-	**LA1**	**LA2**	**ESE**	**Total**
Tutorial	-	30	30	40	100
Practical	2				
Interaction	-	**Credits: 1**			

Course Objectives

1	To 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 Outcomes (CO) with Bloom's Taxonomy Level

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

CO1	Demonstrate the practical aspect of networking related to the theoretical concepts.	Applying
CO2	Simulate, configure and analyze the network using networking tools.	Analyzing

List of Experiments / Lab Activities

List of Experiments:

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
5. Wireshark Labs:ARP.
6. Wireshark Lab: 802.11
7. Configuration of network topology using packet tracer tool
8. Configuration of routing protocols
9. Configuration of IPv6 address using Packet Tracer
10. Capture and analyze TCP and UDP packet using Wireshark
11. Analyzing TCP connection and termination using Wireshark
12. Socket programming using TCP and UDP.
13. Wireshark Lab: HTTP
14. Wireshark Labs: DNS

Text Books	
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.

Useful Links	
1	Nptel Course: Link
2	Udemy Course: Link

CO-PO Mapping

	Programme Outcomes (PO)												**PSO**		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	
CO1	**1**			**2**									**1**		
CO2					**3**										

The strength of mapping is to be written as 1,2,3; Where, 1:Low, 2:Medium, 3:High
Each CO of the course must map to at least one PO.

Assessment

There are three components of lab assessment, LA1, LA2 and Lab ESE.
IMP: Lab ESE is a separate head of passing. LA1, LA2 together is treated as In-Semester Evaluation.

Assessment	**Based on**	**Conducted by**	**Typical Schedule (for 26-week Sem)**	**Marks**
LA1	Lab activities, attendance, journal	Lab Course Faculty	During Week 1 to Week 6 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	10	15	**35**
Analyze	20	20	25	**65**
Evaluate				
Create				
Total Marks	**30**	**30**	**40**	**100**

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Course Information

Programme	B.Tech. (Computer Science and Engineering)
Class, Semester	Second Year B. Tech., Sem IV
Course Code	
Course Name	Programming Lab 2
Desired Requisites:	Object Oriented Paradigm, Object Oriented Concept and basic implementation in C++.

Teaching Scheme (Hrs)		**Examination Scheme (Marks)**			
Lecture	-	**LA1**	**LA2**	**ESE**	**Total**
Tutorial	-	30	30	40	100
Practical	2				
Interaction	-	**Credits: 1**			

Course Objectives

1	To inculcate 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 Outcomes (CO) with Bloom's Taxonomy Level

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

CO1	Convert the real world problem using simple java programing domain and identify the required java object oriented concept	Understanding
CO2	Demonstrate small application using java as a programing language for socio economic importance	Applying

List of Experiments / Lab Activities

List of Experiments:

1. Installation of jdk package, understand the difference between jdk and jre folder, set environment variable PATH/CLASSPATH.
2. Simple hello word program for understanding – java structure, command and steps for executing java program. Also simple program for reading input from user using scanner class.
3. Implementation of different inheritance types, Multiple Inheritance using Interface design combinational and sequential circuit.
4. Implementation of Package and access mechanism in package
5. String class implementation, basic operation, creating immutable and mutable string
6. Exception Handling
7. Implement collection utility classes – list, set, map with their specific methods available in interface or implemented class.
8. Implement exception related to IO and collection classes.
9. Program to read basic data types from keyboard using Scanner and check the entered values data type for its appropriateness
10. Multithreading – display thread information.
11. Multithreading – create thread using Thread and Runnable class.
12. Multithreading – thread communication and synchronization of threads.
13. Design Database program for Employee details and implement INSERT, SELECT, DELETE, and UPDATE queries.
14. Implement ResultSet class.
15. Implement RowSet class.
16. GUI design and Event handling
17. GUI design using Swing package - a) Celsius to Fahrenheit conversion b) Login and Password Verification.
18. Implement exception related to event handling, GUI design.

Text Books	
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
Useful Links	
1	

CO-PO Mapping														
	Programme Outcomes (PO)												**PSO**	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2	2	-	-	3	-	-	-	-	-	-	-	-	-
CO2	2	2	1	-	3	-	-	-	-	-	-	-	-	-

The strength of mapping is to be written as 1,2,3; Where, 1:Low, 2:Medium, 3:High Each CO of the course must map to at least one PO.

Assessment				
There are three components of lab assessment, LA1, LA2 and Lab ESE. IMP: Lab ESE is a separate head of passing. LA1, LA2 together is treated as In-Semester Evaluation.				
Assessment	**Based on**	**Conducted by**	**Typical Schedule (for 26-week Sem)**	**Marks**
LA1	Lab activities, attendance, journal	Lab Course Faculty	During Week 1 to Week 6 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	15	15	15	**45**
Apply	15	15	25	**55**
Analyze				
Evaluate				
Create				
Total Marks	**30**	**30**	**40**	**100**

Walchand College of Engineering, Sangli

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AY 2021-22

Course Information	
Programme	B.Tech. (Computer Science and Engineering)
Class, Semester	Second Year B. Tech., Sem IV
Course Code	
Course Name	Presentation and Report Writing
Desired Requisites:	Basic presentation skills

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	-	**T1**	**T2**	**ESE**	**Total**
Tutorial	-	20	20	60	100
Practical	-				
Interaction	1 Hrs/week	**Credits: 1**			

Course Objectives		
1	enable students to express them with confidence	
2	enable students to create PPT for seminar	
3	enable students to search project topic	
4	enable students to create and present report	
Course Outcomes (CO) with Bloom's Taxonomy Level		
CO1	Demonstrate presentation skills	Apply
CO2	Interpret self -introduction skills	Apply
CO3	Judge Report writing skills	Evaluate
CO4	Identify skills of PPT creation and presentation	Create

List of Experiments / Lab Activities

List of activity/assignments:

1. Video Resume
2. Seminar
3. Synopsis writing
4. Presentation, Etc.

Text Books	
1	How to write technical reports by Springer

References	
1	IEEE publications
2	Overleaf for Latex

Useful Links	
1	https://www.researchgate.net
2	https://www.overleaf.com/learn/latex/Learn_LaTeX_in_30_minutes
3	https://www.elsevier.com/en-in
4	https://ieeexplore.ieee.org/Xplore/home.jsp

CO-PO Mapping

	Programme Outcomes (PO)												PSO		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	
CO1	1				1				1	1					
CO2					1				1	2					
CO3	1				2				1						
CO4	2				2				1	1					

The strength of mapping is to be written as 1,2,3; Where, 1:Low, 2:Medium, 3:High
Each CO of the course must map to at least one PO.

Assessment (for Theory Course)

The assessment is based on 2 in-semester examinations in the form of T1 (Test-1) and T2 (Test-2) of 20 marks each. Also there shall be 1 End-Sem examination (ESE) of 60 marks. T1 shall be typically on modules 1 and 2, T2 based typically on modules 3, 4 and ESE shall be on all modules with nearly 50% weightage on modules 1 to 4 and 50% weightage on modules 5, 6.

Assessment Plan based on Bloom's Taxonomy Level (Marks) For Theory Course

Bloom's Taxonomy Level		T1	T2	ESE	Total
1	Remember				
2	Understand				
3	Apply	15	10	20	45
4	Analyze				
5	Evaluate	5	5	20	30
6	Create		5	20	25
Total		**20**	**20**	**60**	**100**

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							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	20	20	60	100
3	Apply				
4	Analyze				
5	Evaluate				
6	Create				
Total		**20**	**20**	**60**	**100**

Walchand College of Engineering, Sangli

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AY 2021-22

Course Information	
Programme	B.Tech. (Computer Science and Engineering)
Class, Semester	Second Year B. Tech., Sem IV
Course Code	
Course Name	Environment Science
Desired Requisites:	-Nil-

Teaching Scheme		Examination Scheme (Marks)			
Lecture	2 Hrs/week	**T1**	**T2**	**ESE**	**Total**
Tutorial	-	20	20	60	100
Practical	-				
Interaction	-	**Credits: 0**			

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 Outcomes (CO) with Bloom's Taxonomy Level		
CO1	Describe key concepts of Environmental science and their relationship to engineering.	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.	Understanding
CO3	Predict impact of contemporary issues (Population Explosion, Climate change, Environmental pollution) on the environment.	Understanding

Module	Module Contents	Hours
I	**Environment, Ecology and Biodiversity** *Introduction*: Natural and Built Environment, *Environmental Education*: Definition, Scope, Objectives and importance. *Components of the Environment*: Atmosphere, Hydrosphere, Lithosphere and Biosphere. *Ecology*: Introduction, Classification of ecosystems, Structure and functions of ecosystems, Trophic levels, Food chains, Food webs, Ecological pyramids, Ecological succession, Biogeochemical cycles. *Biological Diversity*: Introduction, Values of biodiversity, Hotspots of Biodiversity, Threats to biodiversity, Conservation of biodiversity.	7

II	**Human Population, Energy and Natural Resources** *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 lifestyle. Case studies.	5
III	**Climate Change, Environmental Quality and Pollution Control** *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
IV	**Solid, Hazardous Waste and Disaster Management** *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
V	**Social Issues, Environmental Management and Legislation** *Environmental ethics*: Introduction, Ethical responsibility, issues and possible solutions. *Environmental Management*: Introduction to Environmental Impact Assessment, Environmental Management System: ISO 14001Standard, 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, Wildlife Protection Act 1972, and Forest Conservation Act 1980. Municipal Solid Wastes (Management and Handling) Rules, 2000.	4
VI	**Cleaner technology** 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.	3
Text Books		
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.	
Useful Links		
1	https://www.youtube.com/watch?v=1Ht2uwDh6ro	

2	https://www.youtube.com/watch?v=bvXrL5shxO4&list=PLSsIp6g3OZyVZgG0imE46NCXH3iwvD9SF
3	https://www.youtube.com/watch?v=ZngDF4jfRdw&list=PLyqSpQzTE6M_vO7rLpxKZWqai4uJP2bDa
4	https://www.youtube.com/watch?v=mIPBPG-5dUw

Walchand College of Engineering, Sangli

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AY 2022-23

Course Information	
Programme	B.Tech. (Computer Science and Engineering)
Class, Semester	Third Year B. Tech., Sem V
Course Code	5CS301
Course Name	Compiler Design
Desired Requisites:	Formal Language and Automata Theory, Discrete Mathematics

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	3 Hrs/week	**MSE**	**ISE**	**ESE**	**Total**
Tutorial	-	30	20	50	100
		Credits: 3			

Course Objectives	
1	To introduce fundamentals of compiler design and various tools used to design a compiler
2	To inculcate role of various phases involved during design of a compiler and impart in depth working of each phase
3	To exercise design of various phases of a compiler using compiler design tools and techniques
4	

Course Outcomes (CO) with Bloom's Taxonomy Level

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

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Description**
CO1	Discuss the need of a compiler, fundamental concepts and various tools used to design a compiler.	II	Understanding
CO2	Demonstrate role and working of each phase involved during compilation	III	Applying
CO3	Analyze the working of various phases of compiler	IV	Analyzing
CO4	Assess various phases of compiler using compiler design tools and techniques	V	Evaluating

Module	**Module Contents**	**Hours**
I	**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
II	**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
III	**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

IV	**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
V	**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
VI	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 getReg, DAG, peephole optimization, register allocation and assignment, selection of instruction, register allocation, parallel compilation, Just-in-Time compiler, study of compiler construction tools.	6

Textbooks	
1	A.V. Aho, R. Shethi and J.D. Ullman, "Compilers - Principles, Techniques and Tools", Pearson Education, Second Edition, 2007.
2	D.M. Dhamdhere, "Systems Programming and Operating Systems", Tata McGraw- Hill Publishing Company limited, New Delhi, Second revised Edition, 2005.

References	
1	K Cooper, L Torczon, "Engineering a Compiler", Morgan Kaufmann, Second Edition, 2011
2	John J Donavan, "System Programming", Tata McGraw- Hill Publishing Company limited, New Delhi
3	Sumitabha Das, "Unix Concepts and Administration", TMGH, 3rd Edition
4	A.V. Aho, R. Shethiand J.D. Ullman, "Compilers - Principles, Techniques and Tools", Addison Wesley Publishing Company, 2007

Useful Links	
1	https://onlinecourses.nptel.ac.in/noc21_cs07/preview
2	https://nptel.ac.in/courses/106108052

CO-PO Mapping

	Programme Outcomes (PO)												**PSO**	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2												2	
CO2	3												3	
CO3		3												
CO4	2	2											3	

The strength of mapping is to be written as 1: Low, 2: Medium, 3: High
Each CO of the course must map to at least one PO.

Assessment
The assessment is based on MSE, ISE and ESE. MSE shall be typically on modules 1 to 3. ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO. ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6. For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

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AY 2022-23

Course Information

Programme	B.Tech. (Computer Science and Engineering)
Class, Semester	Third Year B. Tech., Sem V
Course Code	5CS302
Course Name	Design and Analysis of Algorithm
Desired Requisites:	Data structure

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	3 Hrs/week	**MSE**	**ISE**	**ESE**	**Total**
Tutorial	-	30	20	50	100
		Credits: 3			

Course Objectives

1	To illustrate and apply the algorithm 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 Outcomes (CO) with Bloom's Taxonomy Level

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

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Description**
CO1	Discuss the fundamentals of algorithm design and analysis techniques.	II	Understanding
CO2	Apply knowledge of computing and mathematics to algorithm design	III	Applying
CO3	Critically analyze the various algorithm design techniques for a given problem.	IV	Analyzing
CO4	Classify computational problems into P, NP, NP-Hard and NP-Complete.	V	Evaluating
CO5	Design efficient algorithms to improve complexity of existing algorithm.	VI	Creating

Module	**Module Contents**	**Hours**
I	**Introduction** Introduction to Algorithm Analysis Time and Space Complexity, Elementary operations and Computation of Time Complexity-Best, worst and Average Case Complexities- Complexity Calculation of simple algorithms. Recurrence Equations: Solution of Recurrence Equations –Iteration Method and Recursion Tree Methods. Master's theorem for complexity computation.	6
II	**Divide and conquer** Binary Search, Merge sort, Quick sort, Heap Sort, Multiplication of Large Integers, Closest-Pair and Convex, Hull Problems, Strassen's Matrix Multiplication.	7
III	**Greedy Technique** Greedy Technique – Container loading problem, Job sequencing with deadlines, Minimum cost spanning trees, Knapsack problem, Optimal Merge pattern, Huffman Trees.	6
IV	**Dynamic Programming** Principle of optimality – Coin changing problem, Computing a Binomial Coefficient – Floyd's algorithm – Multi stage graph – Optimal Binary Search Trees – 0/1 Knapsack problem and Memory functions.	7

V	**Backtracking** Backtracking-General method, applications The 4, 8-queen problem, sum of subsets problem, graph coloring, Hamiltonian cycles.	6
VI	**Graph Traversal Techniques & Class of problem** Techniques for Graphs – Breadth First Search & Traversal, Depth First Search & Traversal, Topological sorting of DAGs AND/OR graphs, Connected components P, NP, NP- Complete and NP Hard Problems, Approximation Algorithms for NP-Hard Problems.	7

Textbooks	
1	Ellis Horowitz, Sartaj Sahni and Rajasekaran "Fundamentals of Computer Algorithms" , Galgotia Publications, 2nd Edition.
2	Aho, Hopfcraft and Ullman, Addison Wesley "Design and Analysis of Algorithms",
3	
4	
References	
1	Thomas Cormen, Leiserson, Rivest, and Stein "Introduction to Algorithms", PHI Publication. 3rd Edition, 2009
2	Goodman ,"Introduction to Design and Analysis of Algorithm", McGraw Hill.
3	R.C.T. Lee, S.S. Tseng, R.C. Chang, "Introduction to the Design and Analysis of Algorithm", Tata
4	
Useful Links	
1	https://online.stanford.edu/courses/soe-ycsalgorithms1-algorithms-design-and-analysis-part-1
2	
3	
4	

CO-PO Mapping

	Programme Outcomes (PO)												**PSO**	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2	--	--	--	--	--	--	--	--	--	--	--	--	--
CO2	3	1	--	--	--	--	--	--	--	--	--	--	--	--
CO3	--	3	--	2	--	--	--	--	--	--	--	--	--	--
CO4	--	--	--	2	--	--	--	--	--	--	--	--	--	--

The strength of mapping is to be written as 1: Low, 2: Medium, 3: High
Each CO of the course must map to at least one PO.

Assessment

The assessment is based on MSE, ISE and ESE.
MSE shall be typically on modules 1 to 3.
ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO.
ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6.
For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

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AY 2022-23

Course Information

Programme	B.Tech. (Computer Science and Engineering)
Class, Semester	Third Year B. Tech., Sem V
Course Code	5CS351
Course Name	Design and Analysis of Algorithm Lab
Desired Requisites:	Data structure

Teaching Scheme		**Examination Scheme (Marks)**			
Practical	2 Hrs/ Week	**LA1**	**LA2**	**Lab ESE**	**Total**
Interaction	-	30	30	40	100
		Credits: 1			

Course Objectives

1	Learn key techniques for designing and analyzing algorithms.
2	Study fundamental concepts and notations used in Algorithm design.
3	Study and apply different algorithm design methods namely, greedy method, divide and conquer, dynamic programming and backtracking.
4	Study the Parallel architectures for designing parallel algorithms.
5	Design and analyze the complexities of various algorithms following

Course Outcomes (CO) with Bloom's Taxonomy Level

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

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Description**
CO1	Practice different algorithm techniques for given problem.	III	Applying
CO2	Identify appropriate data structure to implement selected algorithmic approach	IV	Analyzing
CO3	Design and Implement an algorithm for complex problem in polynomial time.	VI	Creating
CO4	Exhibit technical and professional skill to demonstrate and convince accomplished algorithmic solution.	III	Applying

List of Experiments / Lab Activities/Topics

List of Topics(Applicable for Interaction mode):

List of Lab Activities:

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 = {s1,s2,.....,sn} 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

Textbooks	
1	Ellis Horowitz, Sartaj Sahni and Rajasekaran "Fundamentals of Computer Algorithms" , Galgotia Publications, 2nd Edition.
2	Aho, Hopfcraft and Ullman, Addison Wesley "Design and Analysis of Algorithms",
3	
4	
References	
1	Thomas Cormen, Leiserson, Rivest, and Stein "Introduction to Algorithms", PHI Publication. 3rd Edition, 2009
2	Goodman ,"Introduction to Design and Analysis of Algorithm", McGraw Hill.
3	R.C.T. Lee, S.S. Tseng, R.C. Chang, "Introduction to the Design and Analysis of Algorithm", Tata
4	
Useful Links	
1	https://online.stanford.edu/courses/soe-ycsalgorithms1-algorithms-design-and-analysis-part-1

CO-PO Mapping														
	Programme Outcomes (PO)												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	--	--	2	--	--	--	--	--	--	--	--	--	--	--
CO2	--	3	--	2	--	--	--	--	--	--	--	--	--	--
CO3	--	--	3	1	--	--	--	--	--	--	--	--	--	--
CO4	--	--	--	2	--	--	--	2	2	2	--	2	--	--
The strength of mapping is to be written as 1,2,3; where, 1: Low, 2: Medium, 3: High Each CO of the course must map to at least one PO, and preferably to only one PO.														

Assessment				
There are three components of lab assessment, LA1, LA2 and Lab ESE. IMP: Lab ESE is a separate head of passing.(min 40 %), LA1+LA2 should be min 40%				
Assessment	**Based on**	**Conducted by**	**Typical Schedule**	**Marks**
LA1	Lab activities, attendance, journal	Lab Course Faculty	During Week 1 to Week 8 Marks Submission at the end of Week 8	30
LA2	Lab activities, attendance, journal	Lab Course Faculty	During Week 9 to Week 16 Marks Submission at the end of Week 16	30
Lab ESE	Lab activities, journal/ performance	Lab Course Faculty and External Examiner as applicable	During Week 18 to Week 19 Marks Submission at the end of Week 19	40
Week 1 indicates starting week of a semester. Lab activities/Lab performance shall include performing experiments, mini-project, presentations, drawings, programming, and other suitable activities, as per the nature and requirement of the lab course. The experimental lab shall have typically 8-10 experiments and related activities if any.				

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Course Information

Programme	B.Tech. (Computer Science Engineering)
Class, Semester	Third Year B. Tech., Sem V
Course Code	5CS352
Course Name	Programming Laboratory-3
Desired Requisites:	Basics of Object-Oriented Programming

Teaching Scheme		**Examination Scheme (Marks)**			
Practical	2 Hrs/ Week	**LA1**	**LA2**	**Lab ESE**	**Total**
Interaction	-	30	30	40	100
		Credits: 1			

Course Objectives

1	to 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.
4	

Course Outcomes (CO) with Bloom's Taxonomy Level

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

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Description**
CO1	summarize the different concepts and components of WWW, web development technologies and web security.	II	Understanding
CO2	illustrate the concepts of different web development technologies using different web development tools.	III	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.	IV	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.	V	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.	VI	Creating

List of Experiments / Lab Activities/Topics

Module 1: Introduction to World Wide Web

Client, Server, Communication, Protocols, Ports, Client-Server Architectures, Internet, World Wide Web, HTTP, HTTP Status Codes, Web Clients/Browsers, and Web Servers.

Experiments:

1. Describe client, server, communication, ports, protocols, HTTP, browsers and web servers.
2. Distinguish between client and server, Internet, WWW, and client-server architectures.
3. Get header information of a web page using browser‟s developer mode.
4. Installation of web server.

Module 2: Markup Languages and Building Web Pages

Introduction to Markup Languages, Introduction to HTML and HTML5, Fundamental HTML Elements, HTML Forms, HTML Media, HTML Graphics, HTML APIs, HTML Web Components.

Experiments:

1. Design and develop web pages using fundamental HTML elements, such as head, title, body, header, comment, etc.
2. Design and develop web pages using HTML Formatting elements, such as abbr, address, etc.
3. Design and develop HTML Forms using HTML Form and Input elements, such as form, input, textarea, etc.
4. Design and develop web pages that embed images and client-side maps, audio and video and links, lists and tables.
5. Design and develop web pages with styles, semantics and layouts, such as header, footer, section, data, div, etc.
6. Design and develop web pages to embed YouTube videos, graphics using canvas and SVG.
7. Design and develop web pages using HTML APIs, web components.

Module 3: Style sheet Languages and Presentation of Web Pages

Introduction to style sheet languages, Introduction to Cascading Style Sheet (CSS), Text Formatting, Colours and Backgrounds, Borders and Margins, Floating and Positioning, Page Layout, Navigation Bars and Dropdowns, CSS Selectors.

Experiments:

1. Design and develop web pages by applying CSS text formatting properties, such as Text Alignment, Text Decoration, Text Transformation, Text Spacing, Text Shadow, Font Family, Font Style, Font Size, etc.
2. Design and develop web pages by applying CSS colors and backgrounds properties, such as colour, RGB, HEX, HSL values, background image, background color, etc.
3. Design and develop web pages by applying CSS borders and margin properties, such as Border Width, Border Color, Margins, etc.
4. Design and develop web pages by applying CSS floating, overflow and positioning properties, such as float, overflow, position, etc.
5. Design and develop web pages by applying CSS page layout properties, such as display, padding, height, width, max-width, align, etc.
6. Design and develop web pages by applying CSS properties to links, lists and tables.
7. Design and develop web pages by using CSS navigation bars and dropdowns.
8. Design and develop web pages by using CSS Selectors.
9. Design and develop web pages by using inline CSS, internal CSS and external CSS.

Module 4: Client-side Programming

JavaScript: Introduction to JavaScript, Basic Syntax, Variables, Data Types, Statements, Operators, Conditions, Loops, Functions, Arrays, Objects, Form Validation, DOM, JavaScript Objects, JavaScript Functions, Asynchronous JavaScript and any one of the state-of-the-art JavaScript libraries.

Experiments:

1. Implement a script using JavaScript that changes HTML content, HTML attributes hides and show HTML elements, HTML output and window alert box for web pages.
2. Implement a script using JavaScript that shows use of JavaScript variables, data types and statements for web pages.
3. Implement a script using JavaScript that shows use of JavaScript Arithmetic, Assignment and String Concatenation operations for web pages.
4. Implement a script using JavaScript that shows use of JavaScript conditionals and loops for web pages.
5. Implement a script using JavaScript that shows use of JavaScript Functions, Arrays, and Objects for web pages.
6. Implement a script using JavaScript that shows use of Asynchronous JavaScript.
7. Design and develop web pages and insert JavaScript in head tag, body tag, external file, external URL and external folder.
8. Implement a script using JavaScript library.

Module 5: Server-side Programming

Introduction to Server-side Programming, Installation of Web and database Server, Process user input, Efficient storage and delivery of information to and from databases, File handling and controlled access to the content, store session/state information, cookies, notifications and communication.

Note:

1. One of the following server-side scripting languages can be used for the implementation: PHP, Node.js, or other state-of-art scripting languages.
2. One of the following databases can be used for data storage and retrieval: MySQL, MongoDB, Firebase or other state-of-art databases.

Experiments:

1. Installation and configuration of web server and database server.
2. Implement basic functionalities of server-side scripting language, such as data types, operators,conditionals, and loops.
3. Implement basic functionalities of server-side scripting language, such as objects, arrays, and functions.
4. Implement web page form validations using server-side scripting language.
5. Implement file handling using server-side scripting language.
6. Implement cookies using server-side scripting language.
7. Implement sessions using server-side scripting language.
8. Implement CRUD operations on database using server-side scripting language.

Module 6: Representation of Web Data, AJAX and Web Security

XML: Introduction to XML, Basics of XML, DTD, Namespaces, XHTML, XPath, XLinks, XQuery and XSLT.

JSON: Introduction to JSON, JSON vs XML, Syntax, Data Types, Parse, Stringify, Objects and Arrays, JSON in HTML.

AJAX: Introduction to AJAX, XMLHttpRequest, AJAX XML, AJAX PHP, and AJAX Database. Web Security: Introduction, types of web threats, and prevention measures.

Experiments:

1. Create a XML file and display in the browser.
2. Create a XML file with the help of namespaces and display in the browser.
3. Create a DTD file and display in the browser.
4. Create and display XSLT file using XML and display in the browser.
5. Create XSLT file using XPath and XPointer and display in the browser.
6. Create a hyperlink using XLinks and display in the browser.
7. Create and display JSON files in HTML.
8. Create a JSON file using basic concepts and use it in HTML.
9. Extract and display the information using XQuery.
10. Implement an AJAX Request-Response with server.
11. Implement an AJAX Request-Response using PHP.
12. Implement an AJAX Request-Response with database.
13. Implementing basic security measures in web development.

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

CO-PO Mapping

	Programme Outcomes (PO)												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2	1				1								
CO2	3	2	2	3	3								1	
CO3		3		2	2									
CO4		2		2	3	1								
CO5			3	2	3	1			3				2	

The strength of mapping is to be written as 1,2,3; where, 1: Low, 2: Medium, 3: High
Each CO of the course must map to at least one PO, and preferably to only one PO.

Assessment

There are three components of lab assessment, LA1, LA2 and Lab ESE.
IMP: Lab ESE is a separate head of passing.(min 40 %), LA1+LA2 should be min 40%

Assessment	Based on	Conducted by	Typical Schedule	Marks
LA1	Lab activities, attendance, journal	Lab Course Faculty	During Week 1 to Week 8 Marks Submission at the end of Week 8	30
LA2	Lab activities, attendance, journal	Lab Course Faculty	During Week 9 to Week 16 Marks Submission at the end of Week 16	30
Lab ESE	Lab activities, journal/ performance	Lab Course Faculty and External Examiner as applicable	During Week 18 to Week 19 Marks Submission at the end of Week 19	40

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

Walchand College of Engineering, Sangli

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Course Information

Programme	B.Tech. (Computer Science Engineering)
Class, Semester	Third Year B. Tech., Sem V
Course Code	5CS345
Course Name	Mini Project – 1
Desired Requisites:	Nil

Teaching Scheme		**Examination Scheme (Marks)**			
Practical	2 Hrs/ Week	**LA1**	**LA2**	**Lab ESE**	**Total**
Interaction	-	30	30	40	100
		Credits: 1			

Course Objectives

1	To use latest design and development tools .
2	To undergo project management techniques and project design principles.
3	To implement the project with appropriate programming languages and testing tools.
4	To develop analytical vision and skills to analyse, compare the outcome with other techniques.

Course Outcomes (CO) with Bloom's Taxonomy Level

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

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Description**
CO1	Demonstrate present technological trends through seminar and presentation.	I	Remember
CO2	Demonstrate the appropriate selection of software tool for project implementation.	II	Understand
CO3	Work in teams and participate in group activity of software development.	III	Apply
CO4	Develop a software product and demonstrate its significance .	V	Evaluate

List of Experiments / Lab Activities/Topics

List of Topics(Applicable for Interaction mode):

List of Lab Activities:

1. The theme of Mini Project 1 should be based on current or previous semester courses completed, focus should be more on the courses which don't have lab courses.
2. Students should maintain a project log book containing weekly progress of the project
3. At the end of the semester the project group should achieve all the proposed objectives of the problem statement.
4. The work should be completed in all aspects of design, implementation and testing.
5. Project report should be prepared and submitted in soft and hard form along with all the code and datasets.
6. Group should demonstrate the work with various test cases and results obtained and explain future scope.
7. The group should participate in technical symposiums, paper presentations to demonstrate their work and findings in technical community.

Textbooks

1	Nil

References

1	Nil

Useful Links	
1	Nil

CO-PO Mapping														
	Programme Outcomes (PO)												**PSO**	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2												3	3
CO2	2	3											3	3
CO3		2		3	2								2	
CO4	2										3			3
The strength of mapping is to be written as 1,2,3; where, 1: Low, 2: Medium, 3: High Each CO of the course must map to at least one PO, and preferably to only one PO.														

Assessment				
There are three components of lab assessment, LA1, LA2 and Lab ESE. IMP: Lab ESE is a separate head of passing.(min 40 %), LA1+LA2 should be min 40%				
Assessment	**Based on**	**Conducted by**	**Typical Schedule**	**Marks**
LA1	Lab activities, attendance, journal	Lab Course Faculty	During Week 1 to Week 8 Marks Submission at the end of Week 8	30
LA2	Lab activities, attendance, journal	Lab Course Faculty	During Week 9 to Week 16 Marks Submission at the end of Week 16	30
Lab ESE	Lab activities, journal/ performance	Lab Course Faculty and External Examiner as applicable	During Week 18 to Week 19 Marks Submission at the end of Week 19	40
Week 1 indicates starting week of a semester. Lab activities/Lab performance shall include performing experiments, mini-project, presentations, drawings, programming, and other suitable activities, as per the nature and requirement of the lab course. The experimental lab shall have typically 8-10 experiments and related activities if any.				

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Course Information

Programme	B.Tech. (Computer Science Engineering)
Class, Semester	Third Year B. Tech., Sem V
Course Code	5CS346
Course Name	Mini Project – 2
Desired Requisites:	Nil

Teaching Scheme		**Examination Scheme (Marks)**			
Practical	2 Hrs/ Week	**LA1**	**LA2**	**Lab ESE**	**Total**
Interaction	-	30	30	40	100
		Credits: 1			

Course Objectives

1	To use latest design and development tools .
2	To undergo project management techniques and project design principles.
3	To implement the project with appropriate programming languages and testing tools.
4	To develop analytical vision and skills to analyse, compare the outcome with other techniques.

Course Outcomes (CO) with Bloom's Taxonomy Level

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

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Description**
CO1	Demonstrate present technological trends through seminar and presentation.	I	Remember
CO2	Demonstrate the appropriate selection of software tool for project implementation.	II	Understand
CO3	Work in teams and participate in group activity of software development.	III	Apply
CO4	Develop a software product and demonstrate its significance .	V	Evaluate

List of Experiments / Lab Activities/Topics

List of Topics(Applicable for Interaction mode):

List of Lab Activities:

1. Mini Project 2 should be on customer specific requirements useful to real life or industry specific, major focus should be on Machine learning / Image Processing / Internet (Web) of Things (Preference should give to the course which are not covered in previous Mini Project 1 task).
2. Students should maintain a project log book containing weekly progress of the project
3. At the end of the semester the project group should achieve all the proposed objectives of the problem statement.
4. The work should be completed in all aspects of design, implementation and testing.
5. Project report should be prepared and submitted in soft and hard form along with all the code and datasets.
6. Group should demonstrate the work with various test cases and results obtained and explain future scope.
7. The group should participate in technical symposiums, paper presentations to demonstrate their work and findings in technical community.

Textbooks

1	Nil

References

1	Nil
Useful Links	
1	Nil

CO-PO Mapping														
	Programme Outcomes (PO)												**PSO**	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2												3	3
CO2	2	3											3	3
CO3		2		3	2								2	
CO4	2										3			3
The strength of mapping is to be written as 1,2,3; where, 1: Low, 2: Medium, 3: High Each CO of the course must map to at least one PO, and preferably to only one PO.														

Assessment				
There are three components of lab assessment, LA1, LA2 and Lab ESE. IMP: Lab ESE is a separate head of passing.(min 40 %), LA1+LA2 should be min 40%				
Assessment	**Based on**	**Conducted by**	**Typical Schedule**	**Marks**
LA1	Lab activities, attendance, journal	Lab Course Faculty	During Week 1 to Week 8 Marks Submission at the end of Week 8	30
LA2	Lab activities, attendance, journal	Lab Course Faculty	During Week 9 to Week 16 Marks Submission at the end of Week 16	30
Lab ESE	Lab activities, journal/ performance	Lab Course Faculty and External Examiner as applicable	During Week 18 to Week 19 Marks Submission at the end of Week 19	40
Week 1 indicates starting week of a semester. Lab activities/Lab performance shall include performing experiments, mini-project, presentations, drawings, programming, and other suitable activities, as per the nature and requirement of the lab course. The experimental lab shall have typically 8-10 experiments and related activities if any.				

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Course Information

Programme	B.Tech. (Computer Science and Engineering)
Class, Semester	Third Year B. Tech., Sem V
Course Code	5HS302
Course Name	Humanities 1: Human Relations at Work
Desired Requisites:	Nil

Teaching Scheme		**Examination Scheme (Marks)**			
Practical		**LA1**	**LA2**	**Lab ESE**	**Total**
Interaction	3 Hrs/ Week	30	30	40	100
		Credits: 3			

Course Objectives

1	To inculcate awareness of human relations at work its relationship with self and the processes involved in interaction with people at work.
2	To provide relevant knowledge to address human relations at work by exposure to personal growth, team building, ethical values and challenges at work
3	To infuse the ability to positively consider other's views and to work effectively with others in team and to support a shared purpose or goal.

Course Outcomes (CO) with Bloom's Taxonomy Level

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

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Description**
CO1	Explain human relations including diversity, attitudes, self-esteem, and interpersonal skills important at workplace.	II	Understanding
CO2	Identify the challenges in decision making, team building, ethical values and effects of stress in the workplace.	II	Understanding
CO3	Describe how theories of motivation, team work and human behaviour impact strategies of the management.	II	Understanding

List of Experiments / Lab Activities/Topics

List of Topics (Applicable for Interaction mode):

1. Human Relations and Personal Growth

Introduction to Human Relations, Understanding and Managing Yourself and Human Relations, Self-Esteem, Self-Confidence, Self-Motivation and Goal Setting, Emotional Intelligence, Attitudes, Happiness, Values, Ethics, Improving Personal and Organizational Communication, Problem Solving and Creativity.

2. Challenges in Human Relations

Dealing effectively with People, Communication in the Workplace, Specialized tactics for getting along with others in the workplace, Becoming an effective leader, Motivating Others, Diversity and Cross-Cultural Competence. Managing or Resolving Conflict and Dealing with Difficult People, A Life Plan for Effective Human Relations

3. Teamwork

Definition, Importance, Benefits of teamwork, Promoting effective teamwork at workplace, Elements of Teamwork, Team Building.

4. Personal Strategies for improving Human Relations

***Staying Physically Healthy*:** Yoga, Pranayama and Exercise, Motivating Yourself, Improving Interpersonal Relations, Achieving Emotional Balance in a Chaotic world, Finding Your Emotional Balance, Building Stronger Relationships with Positive Energy.

5. Individual Career Management

***Staying psychologically healthy*:** Managing Stress and Personal Problems, Meditation. Developing Career Thrust, Getting Ahead in Your Career, Learning and Developing Individual Strategies, Environmental Awareness, Career Goals, Career Strategies, Career Appraisal, Individual Career Management

6. Measures for Successful Human Relations

Developing Good Work Habits. Responding and managing to work related stress, Self-Improvement Plan, Valuing work load, The changing roles of men and women, Sexual harassment of women at workplace, Respect to employees (men, women and transgender).

Textbooks	
1	Shiv Khera, (2014), You Can Win, New edition published by Bloomsbury 2014.
2	John Adair, (2007), The Art of Creative thinking, Kogan Page, Britain and United States.
3	Mathew Allen, (2004), Smart Thinking (2nd edition), Oxford University Press.
4	
References	
1	Greenberg, J. S. (2017). Comprehensive stress management (14th edition). New York: McGraw Hill
2	Dubrien, A. J. (2017). Human Relations for Career and Personal Success: Concepts, Applications and Skills, (11th edition) Upper Saddle River, NJ: Pearson.
3	Alder Ronald B, (2010), Communicating at Work, (10th edition), New York: McGraw Hill
4	
Useful Links	
1	u
2	https://www.youtube.com/watch?v=HkP5VWCxcP0
3	https://www.youtube.com/watch?v=WfWgThjXpXo
4	https://www.youtube.com/watch?v=B7T5rITvMJY
5	https://www.youtube.com/watch?v=4duPBWzf46E
6	https://www.youtube.com/watch?v=KWpGEj2dSR0
7	https://www.youtube.com/watch?v=r8LJ5X2ejqU
8	https://www.youtube.com/watch?v=o1UwpMoHILQ
9	https://www.youtube.com/watch?v=RSlc9IxdBw8
10	https://www.youtube.com/watch?v=cDHGpfpw9kY&list=PLxNHpNhDaEFITDZXhEdybTxMOeh206-Nb

CO-PO Mapping														
	Programme Outcomes (PO)												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1							2			2				
CO2								2	3					
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, and preferably to only one PO.														

Assessment				
There are three components of lab assessment, LA1, LA2 and Lab ESE. IMP: Lab ESE is a separate head of passing.(min 40 %), LA1+LA2 should be min 40%				
Assessment	**Based on**	**Conducted by**	**Typical Schedule**	**Marks**
LA1	Lab activities, attendance, journal	Lab Course Faculty	During Week 1 to Week 8 Marks Submission at the end of Week 8	30
LA2	Lab activities, attendance, journal	Lab Course Faculty	During Week 9 to Week 16 Marks Submission at the end of Week 16	30
Lab ESE	Lab activities, journal/ performance	Lab Course Faculty and External Examiner as applicable	During Week 18 to Week 19 Marks Submission at the end of Week 19	40
Week 1 indicates starting week of a semester. Lab activities/Lab performance shall include performing experiments, mini-project, presentations, drawings, programming, and other suitable activities, as per the nature and requirement of the lab course. The experimental lab shall have typically 8-10 experiments and related activities if any.				

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Course Information	
Programme	B.Tech. (Computer Science and Engineering)
Class, Semester	Third Year B. Tech, Sem V
Course Code	5CS311
Course Name	Elective 1: Image Processing
Desired Requisites:	B.Tech. (Computer Science and Engineering)

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	3 Hrs/week	**MSE**	**ISE**	**ESE**	**Total**
Tutorial	-	30	20	50	100
		Credits: 3			

Course Objectives	
1	To 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 Outcomes (CO) with Bloom's Taxonomy Level

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

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Description**
CO1	Discuss general terminology of digital image processing.	II	Understanding
CO2	Apply and demonstrate image processing algorithms in practical applications	III	Applying
CO3	Illustrate and critique different techniques employed for the enhancement, segmentation, morphology and compression of images	V	Evaluating

Module	**Module Contents**	**Hours**
I	**Digital Image Fundamentals** 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	6
II	**Image Transforms** 2D systems and Necessary Mathematical preliminaries, 2D Orthogonal and Unitary Transforms, KL-Transforms, Hadamard Transforms	6
III	**Image Enhancement** Point Processing, Basic Gray Level Transformations, Histogram Processing, Spatial domain Filtering, Frequency domain filtering	6
IV	**Image Segmentation and Analysis** Edge Detection – using first and second order derivatives, LoG, Canny edge detector, Boundary Extraction – Connectivity, Heuristic Graph Search, Region-based Segmentation – region growing, region splitting and merging, Feature Extraction	8

V	**Morphological Image Processing** Mathematical Morphology, Erosion and Dilation, Opening and Closing, Hit-or-Miss transformation, Basic morphological algorithm: Boundary extraction, Hole filling, Extracting of connected components. Thinning, Thickening	7
VI	**Image Compression** Fundamentals, Compression model, Lossless Vs Lossy Compression, Fundamentals of Information Theory, Run-length coding, Huffman coding, Dictionary-based compression, Image Compression Standards	6

Textbooks	
1	R. C. Gonzalez, R. E. Woods, Digital Image Processing, 4th Edition. 2018, PHI
2	A. K. Jain, Fundamentals of Digital Image Processing, PHI

References	
1	Milan Sonka, Vaclav Hlavac, Boyle, Digital Image Processing and Computer Vision, Cengage Learning
2	S. Jayaraman, S. Esakkirajan, T. Veerkumar, Digital Image Processing, Tata McGrawHill
3	Rafael C. Gonzalez, Richard E. Woods, Steven L. Eddins, Digital Image Processing Using MATLAB, 2nd ed.

Useful Links	
1	NPTEL course: Link
2	NPTEL course: Link

CO-PO Mapping

	Programme Outcomes (PO)												**PSO**	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1		2												
CO2	3		2											
CO3	1			2										
CO4														

The strength of mapping is to be written as 1: Low, 2: Medium, 3: High
Each CO of the course must map to at least one PO.

Assessment

The assessment is based on MSE, ISE and ESE.
MSE shall be typically on modules 1 to 3.
ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO.
ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6.
For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

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Course Information	
Programme	B.Tech. (Computer Science and Engineering)
Class, Semester	Third Year B. Tech., Sem V
Course Code	5CS312
Course Name	Elective 1: Artificial Intelligence and Machine Learning
Desired Requisites:	

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	3 Hrs/week	**MSE**	**ISE**	**ESE**	**Total**
Tutorial	-	30	20	50	100
		Credits: 3			

Course Objectives	
1	To acquaint students with the meaning, purpose, scope, stages, applications, and effects of AI
2	To share the basic tasks and algorithms in Machine Learning
3	To provide understanding of how system learns in supervised learning
4	To understand how machine learning algorithms works for real life problems

Course Outcomes (CO) with Bloom's Taxonomy Level

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

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Description**
CO1	Explain fundamental concepts and challenges in AI and ML	II	Understand
CO2	Create representations of the domain of interest and reason with these representations	III	Apply
CO3	Apply search methods that agents can employ for problem solving.	III, IV	Apply, Analyze
CO4	Recreate machine learning algorithms to solve real life problems and compare the results	VI, IV	Create, Analyze

Module	**Module Contents**	**Hours**
I	**Introduction** Introduction, Reinforcement learning, Intelligent agents, Search Strategies- State space search, Heuristic Search, Backtracking, Finding Optimal Paths: Branch & Bound, A*, Admissibility of A*, A9 Algorithm.	7
II	**Supervised Learning** Machine Learning Paradigms, Predictive Modelling- Classification & Regression, Classification types, Classification Algorithms- Decision Trees, Naïve Bayes, Support Vector Machine, Neural Networks, Performance metrics, Handling Imbalanced Datasets.	7
III	**Knowledge Representation & Reasoning** Introduction to Formal Logics, Propositional Logic, Syntax, Semantics, Forward Chaining, Programming in a Rule Based language.	6
IV	**Regression** Linear Regression with One Variable, Gradient Descent, Gradient Descent for Multiple Variables, Polynomial Regression, Normal Equation Non-invertibility, Logistic Regression, Impact of scaling, learning rate and regularization, Performance measures.	7

V	**Unsupervised Learning** Unsupervised Learning: Introduction, K-Means Algorithm, Optimization Objective, Random Initialization, Choosing the Number of Clusters, KNN Clustering Algorithm, Dimensionality Reduction with PCA.	6
VI	**Game Playing** Game Theory, Board Games and Game Trees, Algorithm Minimax, AlphaBeta and SSS*, Automated Planning: Domain Independent Planning, Blocks World, Forward & Backward Search, Goal Stack Planning, Plan Space Planning	6

Textbooks	
1	Bell J., "*Machine Learning Hands-On for Developers and Technical Professionals*", Wiley 2015
2	Mitchell T. M., "Machine Learning", MGH
3	Marsland S., "*Machine Learning: An Algorithmic Perspective*", Chapman & Hall/CRC, 2nd edition 2014.
4	Khemani D., "*A First Course in Artificial Intelligence*", McGraw Hill Education (India), 2013.

References	
1	Khemani D., "*Artificial Intelligence: Knowledge Representation and Reasoning*", IIT Madras, Lecture Notes.

Useful Links	
1	Artificial Intelligence: Knowledge Representation and Reasoning Course on NPTEL: Link
2	Introduction to Machine Learning Course on NPTEL: Link
3	Machine Learning Course on CourseEra: Link
4	Artificial Intelligence Search Methods for Problem Solving Course on NPTEL: Link

CO-PO Mapping

	Programme Outcomes (PO)												**PSO**	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	1												1	
CO2		2												2
CO3			2										2	
CO4			2											

The strength of mapping is to be written as 1: Low, 2: Medium, 3: High
Each CO of the course must map to at least one PO.

Assessment

The assessment is based on MSE, ISE and ESE.
MSE shall be typically on modules 1 to 3.
ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO.
ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6.
For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

Walchand College of Engineering, Sangli

(Government Aided Autonomous Institute)

AY 2022-23

Course Information

Programme	B.Tech. (Computer Science and Engineering)
Class, Semester	Third Year B. Tech., Sem V
Course Code	5CS313
Course Name	Elective 1: Internet (Web) of Things
Desired Requisites:	Basic programming knowledge

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	3 Hrs/week	**MSE**	**ISE**	**ESE**	**Total**
Tutorial	-	30	20	50	100
		Credits: 3			

Course Objectives

1	To illustrate the basic concepts of Internet of Things.
2	To demonstrate working of Ardino and Raspberry pi.
3	To develop the skill of providing solution for real life problem using IOT.

Course Outcomes (CO) with Bloom's Taxonomy Level

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

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Description**
CO1	Explain how to design and develop Applications in IOT.	III	Apply
CO2	To Illustrate how IOT devices works	III	Apply
CO3	To access different operations using IOT applications.	V	Evaluate
CO4	To produce a program to solve a real-world problem.	VI	Create

Module	**Module Contents**	**Hours**
I	**Introduction to Internet of Things** Introduction, Physical design of IOT, Logical Design of IOT, IOT Enabling Technology.	07
II	**IOT and Communication Protocols** Basics of Networking, Communication Protocols, Sensor Networks, Machine-to Machine Communications	06
III	**Interoperability in IoT** Introduction to Arduino Programming, Introduction to Python programming, Introduction to Raspberry Pi, Implementation of IoT with Raspberry Pi.	06
IV	**Data Analytics for IOT** Apache Hadoop, Apache Oozie, Apache Spark, Using Apache Storm for real time Data analysis.	06
V	**Industrial IoT** Introduction to IIOT, AWS-IOT, Introduction to Lora-wan, Node MCU IOT Platform	07
VI	**Domain Specific IOT Case Studies** Home Automation, Smart Cities, Environment, Energy, Retail, Logistic, Agriculture, Industry, Health and Lifestyle.	07

Textbooks

1	S. Misra, A. Mukherjee, and A. Roy, 2020. Introduction to IoT. Cambridge University Press.
2	S. Misra, C. Roy, and A. Mukherjee, 2020. Introduction to Industrial Internet of Things and Industry 4.0. CRC Press.

References	
1	Arashdeep Bahga ,Vijay Madisetti Internet of Things an Hands on Approach,University Press.
Useful Links	
1	https://onlinecourses.nptel.ac.in/noc21_cs17

CO-PO Mapping														
	Programme Outcomes (PO)												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1		3	3										2	
CO2	1		2										2	
CO3	3	3	2										2	
CO4		2	1										2	
The strength of mapping is to be written as 1: Low, 2: Medium, 3: High Each CO of the course must map to at least one PO.														

Assessment
The assessment is based on MSE, ISE and ESE. MSE shall be typically on modules 1 to 3. ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO. ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6. For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

Walchand College of Engineering, Sangli

(Government Aided Autonomous Institute)

AY 2022-23

Course Information	
Programme	B.Tech. (Computer Science and Engineering)
Class, Semester	Third Year B. Tech., Sem V
Course Code	5CS314
Course Name	Elective 1: Computer Graphics
Desired Requisites:	C/C++ Programming, Data Structures & Files, Java Programming

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	3 Hrs/week	**MSE**	**ISE**	**ESE**	**Total**
Tutorial	-	30	20	50	100
		Credits: 3			

Course Objectives	
1	To introduce 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 world coordinates to device coordinates, clipping, and projections.
5	To be able to discuss the application of computer graphics concepts in the development of computer games, information visualization, and business applications
6	To comprehend and analyze the fundamentals of animation, virtual reality, underlying technologies, principles, and applications.

Course Outcomes (CO) with Bloom's Taxonomy Level

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

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Description**
CO1	Perceive the fundamental concepts of Computer Graphics	II	Understand
CO2	Handle different transformation algorithms.	III	Apply
CO3	Execute 2D Clipping Algorithms	III	Apply
CO4	Appraise acquired transformations with projection using modern tools	IV	Analyze
CO5	Rehash technique of computer animation and its relationship with image and storage	IV	Analyze

Module	**Module Contents**	**Hours**
I	**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; Bradenham‟s generalized integer version; Mid-point rasterization. Circle – Bradenham‟s algorithm; Mid-Point algorithm 1st order difference & 2nd order difference methods	6
II	**2D and 3D introduction** 2D Scan conversion & polygon filling: Active-Edge-List (ybucket) 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	7

III	**2D Clipping** Clipping against regular window – Explicit line clipping; Sutherland & Cohen line clipping, Mid-point subdivision line clipping; Sutherland & Hodgemann polygon clipping	5
IV	**Projection** 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.	5
V	**Computer Animation Introduction**, Key frame animation, Construction of an animation sequence, Motion control methods, Procedural animation, Keyframe animation vs. Procedural animation, Introduction to Morphing, Wraping techniques, Three dimensional morphing.	7
VI	**Image Manipulation and Storage** 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	6

Textbooks	
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, 5 th Edition

References	
1	Procedural Elements for Computer Graphics by David F.Rogers, TMH publication
2	Mathematical Elements for Computer Graphics by David F. Rogers and J. A. Adams, TMH Publication
3	Computer Graphics, principles & practices by J.D. Foley, A. van Dam, S.K. Feiner and J.F. Huges, Addison Wesley
4	Computer Graphics, C version, by D. Hearn and M.P. Baker, Pearson Education
5	Computer Graphics, a programming approach, by S. Harrington, TMH publication
6	Computer Graphics by A.N. Sinha and A.D. Udai, TMH publication

Useful Links	
1	https://www.geeksforgeeks.org/
2	https://nptel.ac.in/courses/106/106/106106090/
3	https://www.youtube.com/playlist?list=PLcZUy0j06PrGTnQUDUfucj6pG5alC4Klo

CO-PO Mapping

	Programme Outcomes (PO)												**PSO**	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2	2	-	-	-	-	-	-	-	-	-	-	1	-
CO2	3	2	2	-	-	-	-	-	-	-	-	-	1	-
CO3	2	2	3	-	-	-	-	-	-	-	-	-	-	-
CO4	1	2	2	-	3	-	-	-	-	-	-	-	-	-

The strength of mapping is to be written as 1: Low, 2: Medium, 3: High
Each CO of the course must map to at least one PO.

Assessment

The assessment is based on MSE, ISE and ESE.
MSE shall be typically on modules 1 to 3.
ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO.
ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6.
For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

Walchand College of Engineering, Sangli

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AY 2022-23

Course Information	
Programme	B.Tech. (Computer Science and Engineering)
Class, Semester	Third Year B. Tech., Sem V
Course Code	5CS316
Course Name	Elective 1: MOOC on Introduction to Game Theory and Mechanism Design
Desired Requisites:	Basic knowledge of probability, algorithms, and (very basic) computational complexity.

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	3 Hrs/week	**MSE**	**ISE**	**ESE**	**Total**
Tutorial	-	30	20	50	100
		Credits: 3			

Course Objectives	
1	To provide a foundation of game theory to help students apply game theory to problem solving in a rigorous way.
2	To get insights of applications of game theory in social decision making.

Course Outcomes (CO) with Bloom's Taxonomy Level

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

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Description**
CO1	To Identify and explain common game theory concepts.	II	Understand
CO2	To design interactions between agents in order to achieve good social outcomes.	III	Apply
CO3	To design and analyse game theoretic solutions to solve real-world problems.	IV	Analyze

Module	**Module Contents**	**Hours**
I	**Introduction to Game Theory** Introduction, the game of chess, proof of chess theorem, normal form games Dominance, Nash equilibrium, Maxmin strategies, elimination of dominated strategies, preservation of pure Nash equilibrium (PSNE), matrix games, relation between maxmin and PSNE in matrix games	07
II	**Mixed strategies** Mixed strategies, mixed strategy Nash equilibrium (MSNE), finding MSNE, MSNE characterization theorem, algorithm to find MSNE Correlated equilibrium (CE), computing CE, extensive form games, subgame perfection, limitations of subgame perfect Nash equilibrium	06
III	**Extensive Form Games** Imperfect information extensive form games (IIEFG), strategies in IIEFGs, equivalence of strategies in IIEFGs, perfect recall Equilibrium in IIEFG, game theory in practice: P2P file sharing, Bayesian games, strategy and utility in Bayesian games, equilibrium in Bayesian games	06
IV	**Basic mechanism design** Introduction to mechanism design, revelation principle, introduction and proof of Arrow's impossibility result, introduction to social choice setup Introduction and proof of Gibbard-Satterthwaite theorem, domain restriction, median voter theorem	06

V	**More mechanism design and auction theory** Task sharing domain, uniform rule, mechanism design with transfers, examples of quasi-linear preferences, Pareto optimality and Groves payments Introduction to VCG mechanism, VCG in Combinatorial allocations, applications to Internet advertising, slot allocation and payments in position auctions, pros and cons of VCG mechanism	07
VI	**Optimal mechanism design** Affine maximizers, single object allocation, Myerson's lemma, optimal mechanism design Single and multi-agent optimal mechanism design, examples of optimal mechanisms	07

Textbooks	
1	Game Theory" — Michael Maschler, Eilon Solan, Shmuel Zamir
2	"Multiagent Systems" — Y. Shoham and K. Leyton Brown, Cambridge University Press, online copy available

References	
1	"Game Theory and Mechanism Design" — Y. Narahari, World Scientific and IISc Press – Indian edition available
2	Martin J. Osborne, An Introduction to Game Theory, Oxford University Press, 2003.

Useful Links	
1	https://onlinecourses.nptel.ac.in/noc22_cs77/preview

CO-PO Mapping

	Programme Outcomes (PO)												**PSO**	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	1		3										2	
CO2	1	2	2										2	
CO3	2	3	2										2	
CO4	1		3										2	

The strength of mapping is to be written as 1: Low, 2: Medium, 3: High
Each CO of the course must map to at least one PO.

Assessment

The assessment is based on MSE, ISE and ESE.
MSE shall be typically on modules 1 to 3.
ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO.
ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6.
For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

Walchand College of Engineering, Sangli

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AY 2022-23

Course Information

Programme	B.Tech. (Computer Science and Engineering)
Class, Semester	Third Year B. Tech., Sem V
Course Code	5CS353
Course Name	Elective 2 Lab: Image Processing Lab
Desired Requisites:	

Teaching Scheme		**Examination Scheme (Marks)**			
Practical	2 Hrs/ Week	**LA1**	**LA2**	**Lab ESE**	**Total**
Interaction	-	30	30	40	100
		Credits: 1			

Course Objectives

1	To share in-depth knowledge of the course
2	To deliver hand-on experience in the field
3	To inculcate interest in different domain areas

Course Outcomes (CO) with Bloom's Taxonomy Level

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

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Description**
CO1	Demonstrate various techniques of image processing related to theoretical knowledge gained.	III	Applying
CO2	To analyse and compare the results of various algorithms	IV	Analysing

List of Experiments / Lab Activities/Topics

List of Topics(Applicable for Interaction mode):

List of Lab Activities:

Lab sessions are to be utilized for problem solving/designing/implementation, to ensure that students have properly learnt the topics covered in the theory course. From below at least 10-12 assignments should be taken

1. Implement and apply different types of image transforms : scaling, rotation, transformation
2. Applying and analysing result of different image processing techniques: thresholding, contrast stretching.
3. Application of histogram equivalization technique
4. Implement image enhancement technique: Unsharp masking
5. Implement image enhancement technique: High boost filtering
6. Apply Different edge detection techniques: (canny, image subtraction etc)
7. Implement and / or apply different image segmentation techniques and analyse them
8. Implement different morphological image operations
9. Apply different image compression techniques

Textbooks

1	R. C. Gonzalez, R. E. Woods, Digital Image Processing, 4th Edition. 2018, PHI
2	A. K. Jain, Fundamentals of Digital Image Processing, PHI

References

1	Milan Sonka, Vaclav Hlavac, Boyle, Digital Image Processing and Computer Vision, Cengage Learning
2	S. Jayaraman, S. Esakkirajan, T. Veerkumar, Digital Image Processing, Tata McGrawHill

3	Rafael C. Gonzalez, Richard E. Woods, Steven L. Eddins, Digital Image Processing Using MATLAB, 2nd ed.
Useful Links	
1	NPTEL course: Link
2	NPTEL course: Link

CO-PO Mapping														
	Programme Outcomes (PO)												**PSO**	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	1			2									1	
CO2					3									
The strength of mapping is to be written as 1,2,3; where, 1: Low, 2: Medium, 3: High Each CO of the course must map to at least one PO, and preferably to only one PO.														

Assessment				
There are three components of lab assessment, LA1, LA2 and Lab ESE. IMP: Lab ESE is a separate head of passing.(min 40 %), LA1+LA2 should be min 40%				
Assessment	**Based on**	**Conducted by**	**Typical Schedule**	**Marks**
LA1	Lab activities, attendance, journal	Lab Course Faculty	During Week 1 to Week 8 Marks Submission at the end of Week 8	30
LA2	Lab activities, attendance, journal	Lab Course Faculty	During Week 9 to Week 16 Marks Submission at the end of Week 16	30
Lab ESE	Lab activities, journal/ performance	Lab Course Faculty and External Examiner as applicable	During Week 18 to Week 19 Marks Submission at the end of Week 19	40
Week 1 indicates starting week of a semester. Lab activities/Lab performance shall include performing experiments, mini-project, presentations, drawings, programming, and other suitable activities, as per the nature and requirement of the lab course. The experimental lab shall have typically 8-10 experiments and related activities if any.				

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Course Information

Programme	B.Tech. (Computer Science Engineering)
Class, Semester	Third Year B. Tech., Sem V
Course Code	5CS354
Course Name	Elective 2 Lab: Artificial Intelligence and Machine Learning Lab
Desired Requisites:	Knowledge of Statistics and Probability

Teaching Scheme		**Examination Scheme (Marks)**			
Practical	2 Hrs/ Week	**LA1**	**LA2**	**Lab ESE**	**Total**
Interaction	-	30	30	40	100
		Credits: 1			

Course Objectives

1	To make students do practical implementation of the different AI and ML concepts and techniques.
2	To make students familiar with steps involved in applying machine learning algorithms to real-life problems
3	To get insights of how pure AI algorithms can be used
4	To develop research interest towards this field

Course Outcomes (CO) with Bloom's Taxonomy Level

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

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Description**
CO1	**Apply** AI and ML algorithms to **solve** real world problems and **analyze** the results.	III, IV	Apply, Analyze
CO2	**Design** and **provide** best solution to AI and ML problems by **measuring** the performance of different algorithms/tools, and **comparing** them.	V, VI	Evaluate, Create

List of Experiments / Lab Activities/Topics

List of Topics(Applicable for Interaction mode):

List of Lab Activities:

1. Represent knowledge in different forms
   a) Logical Representation.
   b) Semantic Networks
   c) Production Rules
   d) Frame Representation.
2. Apply Branch-and-bound technique to Travelling Salesman Problem
3. Apply Backtracking to Sudoku/ N-Queen/ Subset sum problem.
4. Use Minimax approach to find optimal move in a Tic-Tac-Toe Game.
5. Design and implementation of Naïve Bayes Algorithm to find the probability of playing a Golf or not playing it, under given environmental conditions.
6. Adopt procedures to handle imbalanced datasets and compare performance.
7. Perform regression on given House Prices dataset considering one variable (Area) and multiple variables.
8. Implement K-means and KNN Clustering algorithm to given dataset by varying the number of clusters and compare the results.

Mini-project: Group (2/3) students may select topic from research journal/ literature as a problem statement. Design and build the AI system for that problem. OR The problem statement may be assigned group-wise.

Textbooks	
1	Bell J., "*Machine Learning Hands-On for Developers and Technical Professionals*", Wiley 2015
2	Mitchell T. M., "Machine Learning", MGH
3	Marsland S., "*Machine Learning: An Algorithmic Perspective*", Chapman & Hall/CRC, 2nd edition 2014.
4	Khemani D., "*A First Course in Artificial Intelligence*", McGraw Hill Education (India), 2013.
References	
1	Khemani D., "*Artificial Intelligence: Knowledge Representation and Reasoning*", IIT Madras, Lecture Notes.
Useful Links	
1	Artificial Intelligence: Knowledge Representation and Reasoning Course on NPTEL: Link
2	Introduction to Machine Learning Course on NPTEL: Link
3	Machine Learning Course on CourseEra: Link
4	Artificial Intelligence Search Methods for Problem Solving Course on NPTEL: Link

CO-PO Mapping														
	Programme Outcomes (PO)												**PSO**	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3												1	
CO2		2	2		2									3
The strength of mapping is to be written as 1,2,3; where, 1: Low, 2: Medium, 3: High Each CO of the course must map to at least one PO, and preferably to only one PO.														

Assessment				
There are three components of lab assessment, LA1, LA2 and Lab ESE. IMP: Lab ESE is a separate head of passing.(min 40 %), LA1+LA2 should be min 40%				
Assessment	**Based on**	**Conducted by**	**Typical Schedule**	**Marks**
LA1	Lab activities, attendance, journal	Lab Course Faculty	During Week 1 to Week 8 Marks Submission at the end of Week 8	30
LA2	Lab activities, attendance, journal	Lab Course Faculty	During Week 9 to Week 16 Marks Submission at the end of Week 16	30
Lab ESE	Lab activities, journal/ performance	Lab Course Faculty and External Examiner as applicable	During Week 18 to Week 19 Marks Submission at the end of Week 19	40
Week 1 indicates starting week of a semester. Lab activities/Lab performance shall include performing experiments, mini-project, presentations, drawings, programming, and other suitable activities, as per the nature and requirement of the lab course. The experimental lab shall have typically 8-10 experiments and related activities if any.				

Walchand College of Engineering, Sangli

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Course Information

Programme	B.Tech. (Computer Science and Engineering)
Class, Semester	Third Year B. Tech., Sem V
Course Code	5CS355
Course Name	Elective 2 Lab: Internet (Web) of Things Lab
Desired Requisites:	Nil

Teaching Scheme		**Examination Scheme (Marks)**			
Practical	2 Hrs/ Week	**LA1**	**LA2**	**Lab ESE**	**Total**
Interaction	-	30	30	40	100
		Credits: 1			

Course Objectives

1	To share in-depth knowledge of the IOT.
2	To deliver hand-on experience in the field.
3	To inculcate interest in different domain areas

Course Outcomes (CO) with Bloom's Taxonomy Level

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

CO	Course Outcome Statement/s	Bloom's Taxonomy Level	Bloom's Taxonomy Description
CO1	To apply the knowledge gained for solving different problems.	III	Apply
CO2	To Demonstrate basics of IOT	III	Apply
CO3	To analyse and evaluate the solutions and compare them.	V	Evaluate
CO4	To create and implement mini project to solve real life problems.	VI	Create

List of Experiments / Lab Activities/Topics

List of Topics(Applicable for Interaction mode):

List of Lab Activities:

Experiment 1: Arduino basics and Introduction to python programming.
Experiment 2: Study of Raspberry pi.
Experiment 3: Implementation of IOT with Raspberry pi.
Experiment 4: Blink an LED with an Arduino in Tinkercad.
Experiment 5: Smart gate system using Tinkercad.
Experiment 6: Traffic light system using Tinkercad.
Experiment 7: Study of IOT cloud platforms such as ThingSpeak AWS IOT core, Microsoft Azure IOT Hub, Cisco IOT cloud connect etc.
Experiment 8: Study Amazon web services-IOT
Experiment 9: Implementation of Amazon S3, Amazon Dynamo DB, AWS Lambda, Amazon SNS.
Experiment 10: Study of Node MCU IOT platform.
Experiment 11: Introduction to Lora-Wan.
Experiment 12: Any Mini project implementation using concepts of IOT.

Textbooks

1	Mandler B., Barja J., Campista Mitre, M.E., Cagá_ová, D. Chaouchi, H. Zeadally, S. Badra, M. Giordano, S. Fazio, M. Somov, A. Vieriu, R.-L., "Internet of Things. IoT Infrastructures" , Springer International Publishing, Second International Summit, IoT 360° 2015, Rome, Italy, October 27-29, 2015. Revised Selected Papers, Part I
2	Kyung, C.-M., Yasuura, H. Liu, Y. Lin, Y.-L., "Smart Sensors and Systems", Springer International Publishing,2017.

References

1	Hersent Olivier, Boswarthick David , Elloumi Omar , “The Internet of Things: Key Applications and Protocols”, Wiley-Blackwell, Second Edition ,2012
2	S. Misra, A. Mukherjee, and A. Roy, 2020. Introduction to IoT. Cambridge University Press.
3	S. Misra, C. Roy, and A. Mukherjee, 2020. Introduction to Industrial Internet of Things and Industry 4.0. CRC Press.
Useful Links	
1	https://onlinecourses.nptel.ac.in/noc21_cs17/preview
2	https://www.tinkercad.com/things/55ubLwvGK0g-1st-iot-project

CO-PO Mapping

	Programme Outcomes (PO)												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1					1	1					2		3	
CO2					1	1					2		3	
CO3					1	1					2		3	
CO4					1	1					2		3	

The strength of mapping is to be written as 1,2,3; where, 1: Low, 2: Medium, 3: High
Each CO of the course must map to at least one PO, and preferably to only one PO.

Assessment

There are three components of lab assessment, LA1, LA2 and Lab ESE.
IMP: Lab ESE is a separate head of passing.(min 40 %), LA1+LA2 should be min 40%

Assessment	Based on	Conducted by	Typical Schedule	Marks
LA1	Lab activities, attendance, journal	Lab Course Faculty	During Week 1 to Week 8 Marks Submission at the end of Week 8	30
LA2	Lab activities, attendance, journal	Lab Course Faculty	During Week 9 to Week 16 Marks Submission at the end of Week 16	30
Lab ESE	Lab activities, journal/ performance	Lab Course Faculty and External Examiner as applicable	During Week 18 to Week 19 Marks Submission at the end of Week 19	40

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

Walchand College of Engineering, Sangli

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Course Information

Programme	B.Tech. (Computer Science Engineering)
Class, Semester	Third Year B. Tech., SemV
Course Code	5CS356
Course Name	Elective 2 Lab: Computer Graphics Lab
Desired Requisites:	C/C++ Programming, Data Structures & Files, Java Programming

Teaching Scheme		**Examination Scheme (Marks)**			
Practical	2 Hrs/ Week	**LA1**	**LA2**	**Lab ESE**	**Total**
Interaction	-	30	30	40	100
		Credits: 1			

Course Objectives

1	To 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 world coordinates to device coordinates, clipping, and projections.
5	To be able to discuss the application of computer graphics concepts in the development of computer games, information visualization, and business applications.
6	To comprehend and analyze the fundamentals of animation, virtual reality, underlying technologies, principles, and applications.

Course Outcomes (CO) with Bloom's Taxonomy Level

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

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Description**
CO1	Outline the fundamental concepts of Computer Graphics.	II	Understand
CO2	Illustrate the fundamental concepts of computer graphics with its different transformations using algorithms.	III	Applying
CO3	Solve different algorithms on 2D clipping	III	Applying
CO4	Investigate acquired transformations with projection.	IV	Analyzing
CO5	Scrutinize technique of computer animation and figure out relation with image and storage.	IV	Analyzing

List of Experiments / Lab Activities/Topics

List of Topics(Applicable for Interaction mode):

List of Lab Activities:

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

Textbooks	
1	"Mathematical Elements for Computer Graphics", David F. Rogers, J Alan, Adams, TMGH, 2nd Edition
2	"Procedural Elements for Computer Graphics", David F. Rogers, TMGH, 2nd Edition
3	"Interactive Comp. Graphics, A Top-Down Approach using OpenGL", Edward Angel, Pearson, 5th Edition

References	
1	Procedural Elements for Computer Graphics by David F.Rogers, TMH publication.
2	Mathematical Elements for Computer Graphics by David F. Rogers and J. A. Adams, TMH publication.
3	Computer Graphics, principles & practices by J.D. Foley, A. van Dam, S.K. Feiner and J.F. Huges, Addison Wesley.
4	Computer Graphics, C version, by D. Hearn and M.P. Baker, Pearson Education.
5	Computer Graphics, a programming approach, by S. Harrington, TMH publication.
6	Computer Graphics by A.N. Sinha and A.D. Udai, TMH publication

Useful Links	
1	https://www.youtube.com/playlist?list=PLcZUy0j06PrGTnQUDUfucj6pG5alC4Klo

CO-PO Mapping

	Programme Outcomes (PO)												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2	2	1	-	-	-	-	-	-	-	-	-	-	-
CO2	3	2	1	2	-	-	-	-	-	-	-	-	-	-
CO3	-	2	1	-	2	-	-	-	-	-	-	-	3	-
CO4	1	2	1	2	3	-	-	-	-	-	-	2	-	-
CO5	1	2	1	-	3	-	-	-	-	-	-	-	-	-

The strength of mapping is to be written as 1,2,3; where, 1: Low, 2: Medium, 3: High
Each CO of the course must map to at least one PO, and preferably to only one PO.

Assessment

There are three components of lab assessment, LA1, LA2 and Lab ESE.
IMP: Lab ESE is a separate head of passing.(min 40 %), LA1+LA2 should be min 40%

Assessment	Based on	Conducted by	Typical Schedule	Marks
LA1	Lab activities, attendance, journal	Lab Course Faculty	During Week 1 to Week 8 Marks Submission at the end of Week 8	30
LA2	Lab activities, attendance, journal	Lab Course Faculty	During Week 9 to Week 16 Marks Submission at the end of Week 16	30
Lab ESE	Lab activities, journal/ performance	Lab Course Faculty and External Examiner as applicable	During Week 18 to Week 19 Marks Submission at the end of Week 19	40
Week 1 indicates starting week of a semester. Lab activities/Lab performance shall include performing experiments, mini-project, presentations, drawings, programming, and other suitable activities, as per the nature and requirement of the lab course. The experimental lab shall have typically 8-10 experiments and related activities if any.				

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Course Information	
Programme	B.Tech. (Computer Science Engineering)
Class, Semester	Third Year B. Tech., SemV
Course Code	5CS358
Course Name	Elective 2 Lab: Introduction to Game Theory and Mechanism Design Lab
Desired Requisites:	

Teaching Scheme		Examination Scheme (Marks)			
Practical	2 Hrs/ Week	**LA1**	**LA2**	**Lab ESE**	**Total**
Interaction	-	30	30	40	100
		Credits: 1			

Course Objectives

1	To share in-depth knowledge of the course
2	To deliver hand-on experience in the field
3	To inculcate interest in different domain areas

Course Outcomes (CO) with Bloom's Taxonomy Level

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

CO	Course Outcome Statement/s	Bloom's Taxonomy Level	Bloom's Taxonomy Description
CO1	To apply game theory concepts.	III	Applying
CO2	To demonstrate the concepts using various tools.	III	Applying
CO3	To analyse game theoretic solutions.	IV	Analyzing

List of Experiments / Lab Activities/Topics

List of Topics(Applicable for Interaction mode):

List of Lab Activities:

Minimum 8 experiments will be performed to implement the concepts from Game Theory and Mechanism design based on theory MOOC course.

Textbooks

1	Game Theory" — Michael Maschler, Eilon Solan, Shmuel Zamir
2	"Multiagent Systems" — Y. Shoham and K. Leyton Brown, Cambridge University Press, online copy available

References

1	"Game Theory and Mechanism Design" — Y. Narahari, World Scientific and IISc Press – Indian edition available

Useful Links

1	https://onlinecourses.nptel.ac.in/noc22_cs77/

CO-PO Mapping														
	Programme Outcomes (PO)												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2	2	1	-	-	-	-	-	-	-	-	-	-	-
CO2	3	2	1	2	-	-	-	-	-	-	-	-	-	-
CO3	-	2	1	-	2	-	-	-	-	-	-	-	3	-

The strength of mapping is to be written as 1,2,3; where, 1: Low, 2: Medium, 3: High
Each CO of the course must map to at least one PO, and preferably to only one PO.

Assessment

There are three components of lab assessment, LA1, LA2 and Lab ESE.
IMP: Lab ESE is a separate head of passing.(min 40 %), LA1+LA2 should be min 40%

Assessment	Based on	Conducted by	Typical Schedule	Marks
LA1	Lab activities, attendance, journal	Lab Course Faculty	During Week 1 to Week 8 Marks Submission at the end of Week 8	30
LA2	Lab activities, attendance, journal	Lab Course Faculty	During Week 9 to Week 16 Marks Submission at the end of Week 16	30
Lab ESE	Lab activities, journal/ performance	Lab Course Faculty and External Examiner as applicable	During Week 18 to Week 19 Marks Submission at the end of Week 19	40

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

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Course Information	
Programme	B.Tech. (Computer Science and Engineering)
Class, Semester	Third Year B. Tech., Sem V
Course Code	5OE372
Course Name	Open Elective-1: Data Science using Python
Desired Requisites:	Nil

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	2 Hrs/week	**MSE**	**ISE**	**ESE**	**Total**
Tutorial	-	30	20	50	100
		Credits: 2			

Course Objectives

1	Introduce python as a programming language
2	Introduce the mathematical foundations required for data science
3	Introduce the first level data science algorithms
4	Introduce a practical capstone case study

Course Outcomes (CO) with Bloom's Taxonomy Level

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

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Description**
CO1	Explain a flow process for data science problems	II	Understand
CO2	Implement Python codes for data science solutions	III	Apply
CO3	Correlate results to the solution approach followed	III	Apply
CO4	Construct use cases to validate approach and identify modifications required	IV	Analyze

Module	**Module Contents**	**Hours**
I	**Introduction and Programming in python** Introduction to Data Science, Introduction to basics of Python, Tables, Building Tables	4
II	**Data Visualization** Census, Charts, Histograms, Functions, Groups	5
III	**Introduction to Statistics** Iteration, Chance, Sampling, Models, Comparing Distributions	4
IV	**Hypothesis Testing** A/B Testing, Causality, Confidence Intervals, Interpreting Confidence, Center and Spread, The Normal Distribution	5
V	**Classification and Regression** Classification, Classifiers, Correlation, Linear Regression, Logistic Regression	4
VI	**Classification and Regression Case Studies** Residuals, Regression Inference, Case Study	4

Textbooks

1	Computational and Inferential Thinking, The Foundations of Data Science By Ani Adhikari and John DeNero UC Berkeley. (Available Online)
2	The Elements of Statistical Learning, Data Mining, Inference, and Prediction (2nd Edn.), Trevor Hastie Robert Tibshirani, Jerome Friedman, Springer, 2014

References	
1	Probability & Statistics for Engineers & Scientists (9th Edn.), Ronald E. Walpole, Raymond H. Myers, Sharon L. Myers and Keying Ye, Prentice Hall Inc.

Useful Links	
1	http://data8.org/

CO-PO Mapping

	Programme Outcomes (PO)												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2													2
CO2					3									
CO3			2									1		
CO4			3	3									3	

The strength of mapping is to be written as 1: Low, 2: Medium, 3: High
Each CO of the course must map to at least one PO.

Assessment

The assessment is based on MSE, ISE and ESE.
MSE shall be typically on modules 1 to 3.
ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO.
ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6.
For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

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Course Information

Programme	B.Tech. (Computer Science and Engineering)
Class, Semester	Third Year B. Tech., Sem V
Course Code	5OE371
Course Name	Open Elective-2 Software Engineering and Database Essentials
Desired Requisites:	Nil

Teaching Scheme		**Examination Scheme (Marks)**			
Practical	3 Hrs/ Week	**MSE**	**ISE**	**ESE**	**Total**
Interaction	-	30	20	50	100
		Credits: 3			

Course Objectives

1	Understand importance of engineering approach to software development and comprehend the knowledge of software processes & models practiced at IT industries.
2	Be acquainted with the SDLC phases in detail and appreciate the importance of software quality by virtue of software testing methods.
3	To use conceptual designs to prepare database schemas.
4	To understand the relational model and the theoretical issues associated with relational database Design.
5	To learn SQL and Database Architectures.

Course Outcomes (CO) with Bloom's Taxonomy Level

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

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Description**
CO1	explain proficiency to undertake software projects based on software engineering practices.	II	understanding
CO2	summarizing the spirit of team-working in SDLC phases & project planning benefits.	II	understanding
CO3	describe the conceptual designs of Database, identifies the need, analyse the problem and Design ER diagram as well as prepare the relational database schema.	I, IV	Remembering, Analysing
CO4	apply SQL to extract required information from the database. Compare, analyses various ways of writing the queries for a given problem and Differentiating database Architecture.	IV	Analysing

Module	**Module Contents**	**Hours**
I	**Introduction Software Engineering Basics** Software Crisis, Need of software engineering approach. Software Processes: project management process, software development process models, Configuration management process, process management process.	7
II	**Software Quality & Project Planning** **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.	6
III	**Software Development Phases** Software Requirement Process, Design principles, Structured design methodology, Coding Standards, levels of Testing.	6

IV	**Introduction and Database Modelling using ER Model** **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	6
V	**Relational Model and SQL** **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, **SQL:** Introduction to SQL, Data definition statements with constraints, Insert, Update and Delete, Set Operations, Aggregate functions group by and having clauses, Nested Queries, Views, Joins.	8
VI	**Database Architectures** Centralized &Client-Server architectures, server system architecture, Architectures for parallel databases, Distributed database concepts, Homogeneous & Heterogeneous databases, distributed data storage, data fragmentation, and replication and allocation techniques for distributed database.	6

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
Useful Links	
1	https://www.javatpoint.com/software-engineering-tutorial
2	https://www.w3schools.com/sql/trysql.asp?filename=trysql_asc

CO-PO Mapping														
	Programme Outcomes (PO)												**PSO**	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3					2	1							
CO2			3						3		1			
CO3			3	1										
CO4		2			2								1	
The strength of mapping is to be written as 1,2,3; where, 1: Low, 2: Medium, 3: High Each CO of the course must map to at least one PO, and preferably to only one PO.														

Assessment
The assessment is based on MSE, ISE and ESE. MSE shall be typically on modules 1 to 3. ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO. ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6. For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

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Course Information	
Programme	B.Tech. (Computer Science and Engineering)
Class, Semester	Third Year B. Tech., Sem VI
Course Code	5CS321
Course Name	Cloud Computing
Desired Requisites:	Operating System, Computer Networks

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	3 Hrs/week	**MSE**	**ISE**	**ESE**	**Total**
Tutorial	-	30	20	50	100
		Credits: 3			

Course Objectives

1	An understanding of fundamental ideas behind Cloud Computing, the evolution of the paradigm, its applicability; benefits, as well as current and future challenges.
2	Providing basic ideas and principles in cloud management techniques, virtualization techniques and cloud software deployment considerations.
3	Exploring cloud computing driven open source and commercial systems and applications.

Course Outcomes (CO) with Bloom's Taxonomy Level

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

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Description**
CO1	Distinguish concepts of distributed paradigm from other computing paradigm and the mechanism of inter process communication in distributed systems.	II	Understanding
CO2	Describe main concepts, key technologies, strengths, and limitations of cloud computing and the possible applications for state-of-the-art cloud computing.	II	Understanding
CO3	Illustrate different cloudinfrastructure models, cloud computing architecture and various deployment models.	III	Applying
CO4	Classify different hypervisors and virtualization techniques based on their characteristics.	IV	Analyzing
CO5	Identify core issues of cloud computing such as security, privacy, and interoperability.	IV	Analyzing
CO6	Examine the components of Open and commercial cloud platform.	IV	Analyzing

Module	**Module Contents**	**Hours**
I	**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. GraphQL, REST API.	7
II	**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.	5

III	**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.	7
IV	**Virtualization** Introduction, characteristics of virtualized environments, Taxonomy of virtualization Techniques, Virtualization and cloud computing, Pros and Cons of virtualization, technology Examples, Micro-services, Serverless architecture, Hypervisors, Containerization.	6
V	**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, AWS IAM.	6
VI	**Case Study on Open Source & Commercial Clouds** Eucalyptus, Microsoft Azure, Amazon EC2, Open Stack, Open Nebula, AWS, Free Amazon tiers and Google compute, Problems related to Big data analytics, Metering and Monitoring of cloud infrastructure.	8

Textbooks	
1	RajkumarBuyya, James Broberg, Andrzej M. Goscinski ,"Cloud Computing: Principles and Paradigms", Wiley, 1 Edition 2013.
2	GautamShroff,"Enterprise Cloud Computing - Technology, Architecture, Applications", Cambridge University Press, 2010.
3	Ronald L. Krutz, Russell Dean Vines ,"Cloud Security: A Comprehensive Guide to Secure Cloud Computing", Wiley- India,2010.

References	
1	Barrie Sosinsky,"Cloud Computing Bible", Wiley-India, 2010.

Useful Links	
1	

CO-PO Mapping

	Programme Outcomes (PO)												**PSO**	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	1													
CO2		2											2	
CO3		2											1	
CO4		2											1	
CO5		2											1	
CO6		2	2											

The strength of mapping is to be written as 1: Low, 2: Medium, 3: High
Each CO of the course must map to at least one PO.

Assessment
The assessment is based on MSE, ISE and ESE. MSE shall be typically on modules 1 to 3. ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO. ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6. For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

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Course Information	
Programme	B.Tech. (Computer Science and Engineering)
Class, Semester	Third Year B. Tech., Sem VI
Course Code	5CS322
Course Name	Advanced Database Systems
Desired Requisites:	Database Engineering

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	3 Hrs/week	**MSE**	**ISE**	**ESE**	**Total**
Tutorial	-	30	20	50	100
		Credits: 3			

Course Objectives	
1	An understanding of the fundamentals in object-based databases and explore the database centric design issues involved in application development, the advances in database system.
2	Providing the methodology to implement the complex and real-world database applications.
3	Evaluation and analysis of the different types of advanced databases.

Course Outcomes (CO) with Bloom's Taxonomy Level

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

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Description**
CO1	**Exploit** the fundamental concepts involved in advanced databases and apply it in complex data handling.	III	Apply
CO2	**Analyse** the architectures and performance of different databases using **modern tools** for domain specific applications.	IV	Analyse
CO3	**Recommend** the optimal database-based solution to solve real world problem.	V	Evaluate
CO4	**Apply** the acquired knowledge in databases to **design** and **build** the different business applications.	VI	Create

Module	**Module Contents**	**Hours**
I	**Object-Based Databases** Overview, Complex Data Types, Structure Types and Inheritance in SQL, Table Inheritance, Arrays and Multiset Types in SQL, Object-Identity and Reference Types in SQL, Implementing O-R Features, Object-Relational Mapping	5
II	**Application development & Administration** Application Programs and User Interfaces, Application Architectures, Standardization, Rapid Application Development, Application Performance, Application Security. Performance Tuning, Performance Benchmarks, Other issues in Application Development	6
III	**Data Warehousing** Introduction, Data Warehouse Building Blocks, Data Warehouse Architecture, Data warehouse design process, dimensional modelling, conceptual modelling, Multi-dimensional data – cube, building the data warehouse – Data Extraction, Transformation and Loading (ETL Process)	8

IV	**Distributed and Cloud Databases** **Distributed databases:** Homogeneous & heterogeneous databases, distributed data storage, distributed transactions, concurrency control in distributed databases, distributed query processing, Heterogeneous distributed databases. **Cloud Databases – I** 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.	4 3
V	**Cloud Databases – II** Case study of any four NoSQL databases: Voldemort , MongoDB , Cassandra , Neo4J , Cloud Native , Data Lake	7
VI	**Spatial, Temporal Data and Mobility** Motivation, Time in Databases, Spatial and Geographic Data, Multimedia Databases, Mobility and Personal Databases.	6

Textbooks	
1	Silberschatz, Korth, Sudarshan "Database system concepts" MGH 6th Edition.
2	Raghu Ramkrishnan "Database Management System" MGH
3	Paulraj Ponniah "Data Warehousing - Fundamentals for IT Professional" 2nd Edition. Wiley

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
4	W. H. Inmon, "Building the Data Warehouse" Wiley Dreamtech India Pvt. Ltd...
5	RALPH KIMBALL, "The Data Warehouse Life cycle Tool kit" WILEY STUDENT EDITION

Useful Links	
1	https://nptel.ac.in/courses/106/106/106106093/
2	https://freevideolectures.com/course/2280/database-design/37
3	https://onlinecourses.nptel.ac.in/noc21_cs04/preview
4	https://onlinecourses.nptel.ac.in/noc21_cs58/preview
5	https://docs.oracle.com/en/database/oracle/oracle-database/21/dwhsg/

CO-PO Mapping

	Programme Outcomes (PO)												**PSO**	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3												2	
CO2					2								2	2
CO3			2										2	
CO4			3										1	3

The strength of mapping is to be written as 1: Low, 2: Medium, 3: High
Each CO of the course must map to at least one PO.

Assessment
The assessment is based on MSE, ISE and ESE. MSE shall be typically on modules 1 to 3. ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO. ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6. For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

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Course Information

Programme	B.Tech. (Computer Science Engineering)
Class, Semester	Third Year B. Tech., Sem VI
Course Code	5CS371
Course Name	Advanced Database System Laboratory
Desired Requisites:	Database Engineering

Teaching Scheme		**Examination Scheme (Marks)**			
Practical	2 Hrs/ Week	**LA1**	**LA2**	**Lab ESE**	**Total**
Interaction	-	30	30	40	100
		Credits: 1			

Course Objectives

1	Practicing the concepts/techniques studied in theory course.
2	Providing hands-on with different database servers / platforms / tools.
3	Designing and implementation of the database based applications.

Course Outcomes (CO) with Bloom's Taxonomy Level

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

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Description**
CO1	Scrutinize different database servers, application architectures / models, frameworks and identify optimal one, suitable for particular application.	IV	Analyze
CO2	Select the advanced/modern databases and recommend for prediction and modelling of complex real world data.	V	Evaluate
CO3	Design and build the different enterprise applications using modern tools.	VI	Create

List of Experiments / Lab Activities/Topics

List of Topics(Applicable for Interaction mode):

List of Lab Activities:

1. Minimum 12 assignments or 6 mini-projects should be practice/perform based on the understanding of concepts covered in theory course.
2. The detail list of assignments/mini-projects will be display by subject teacher.
3. Explore to all the state of the art technology related to each module in theory course.
4. Use industry standard development tools for above laboratory work.
5. All assignments/laboratory work should follow software engineering standards.

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
Useful Links	
1	Parallel processing :- https://docs.oracle.com/cd/A58617_01/server.804/a58238/ch2_succ.htm
2	Distributed database:- https://docs.oracle.com/database/121/ADMIN/ds_concepts.htm#ADMIN12134
3	www.mongodb.com , https://cassandra.apache.org
4	https://neo4j.com/developer/cypher/

CO-PO Mapping

	Programme Outcomes (PO)												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1													2	
CO2					2								2	
CO3					3						1		2	3
CO4													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, and preferably to only one PO.

Assessment

There are three components of lab assessment, LA1, LA2 and Lab ESE.
IMP: Lab ESE is a separate head of passing.(min 40 %), LA1+LA2 should be min 40%

Assessment	Based on	Conducted by	Typical Schedule	Marks
LA1	Lab activities, attendance, journal	Lab Course Faculty	During Week 1 to Week 8 Marks Submission at the end of Week 8	30
LA2	Lab activities, attendance, journal	Lab Course Faculty	During Week 9 to Week 16 Marks Submission at the end of Week 16	30
Lab ESE	Lab activities, journal/ performance	Lab Course Faculty and External Examiner as applicable	During Week 18 to Week 19 Marks Submission at the end of Week 19	40

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

Walchand College of Engineering, Sangli

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Course Information

Programme	B.Tech. (Computer Science Engineering)
Class, Semester	Third Year B. Tech., Sem VI
Course Code	5CS347
Course Name	Mini Project – 3
Desired Requisites:	Nil

Teaching Scheme		**Examination Scheme (Marks)**			
Practical	2 Hrs/ Week	**LA1**	**LA2**	**Lab ESE**	**Total**
Interaction	-	30	30	40	100
		Credits: 1			

Course Objectives

1	To use latest design and development tools .
2	To undergo project management techniques and project design principles.
3	To implement the project with appropriate programming languages and testing tools.
4	To develop analytical vision and skills to analyse, compare the outcome with other techniques.

Course Outcomes (CO) with Bloom's Taxonomy Level

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

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Description**
CO1	Demonstrate present technological trends through seminar and presentation.	I	Remember
CO2	Demonstrate the appropriate selection of software tool for project implementation.	II	Understand
CO3	Work in teams and participate in group activity of software development.	III	Apply
CO4	Develop a software product and demonstrate its significance .	V	Evaluate

List of Experiments / Lab Activities/Topics

List of Topics(Applicable for Interaction mode):

List of Lab Activities:

1. The theme of Mini Project 3 should be based on current or previous semester courses completed, focus should be more on the courses which doesn't have lab course (Preference should give to the course which are not covered in previous Mini Project 1/2 task).
2. Students should maintain a project log book containing weekly progress of the project
3. At the end of the semester the project group should achieve all the proposed objectives of the problem statement.
4. The work should be completed in all aspects of design, implementation and testing.
5. Project report should be prepared and submitted in soft and hard form along with all the code and datasets.
6. Group should demonstrate the work with various test cases and results obtained and explain future scope.
7. The group should participate in technical symposiums, paper presentations to demonstrate their work and findings in technical community.

Textbooks

1	Nil

References

1	Nil
Useful Links	
1	Nil

CO-PO Mapping														
	Programme Outcomes (PO)												**PSO**	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2												3	3
CO2	2	3											3	3
CO3		2		3	2								2	
CO4	2										3			3
The strength of mapping is to be written as 1,2,3; where, 1: Low, 2: Medium, 3: High Each CO of the course must map to at least one PO, and preferably to only one PO.														

Assessment				
There are three components of lab assessment, LA1, LA2 and Lab ESE. IMP: Lab ESE is a separate head of passing.(min 40 %), LA1+LA2 should be min 40%				
Assessment	**Based on**	**Conducted by**	**Typical Schedule**	**Marks**
LA1	Lab activities, attendance, journal	Lab Course Faculty	During Week 1 to Week 8 Marks Submission at the end of Week 8	30
LA2	Lab activities, attendance, journal	Lab Course Faculty	During Week 9 to Week 16 Marks Submission at the end of Week 16	30
Lab ESE	Lab activities, journal/ performance	Lab Course Faculty and External Examiner as applicable	During Week 18 to Week 19 Marks Submission at the end of Week 19	40
Week 1 indicates starting week of a semester. Lab activities/Lab performance shall include performing experiments, mini-project, presentations, drawings, programming, and other suitable activities, as per the nature and requirement of the lab course. The experimental lab shall have typically 8-10 experiments and related activities if any.				

Walchand College of Engineering, Sangli

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Course Information

Programme	B.Tech. (Computer Science Engineering)
Class, Semester	Third Year B. Tech., Sem VI
Course Code	5CS348
Course Name	Mini Project – 4
Desired Requisites:	Nil

Teaching Scheme		**Examination Scheme (Marks)**			
Practical	2 Hrs/ Week	**LA1**	**LA2**	**Lab ESE**	**Total**
Interaction		30	30	40	100
		Credits: 1			

Course Objectives

1	To use latest design and development tools .
2	To undergo project management techniques and project design principles.
3	To implement the project with appropriate programming languages and testing tools.
4	To develop analytical vision and skills to analyse, compare the outcome with other techniques.

Course Outcomes (CO) with Bloom's Taxonomy Level

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

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Description**
CO1	Demonstrate present technological trends through seminar and presentation.	I	Remember
CO2	Demonstrate the appropriate selection of software tool for project implementation.	II	Understand
CO3	Work in teams and participate in group activity of software development.	III	Apply
CO4	Develop a software product and demonstrate its significance .	V	Evaluate

List of Experiments / Lab Activities/Topics

List of Topics(Applicable for Interaction mode):

List of Lab Activities:

1. Mini Project 4 should be on customer specific requirements useful to real life or industry specific, major focus should be on Machine learning / Image Processing / Internet (Web) of Things (Preference should give to the course which are not covered in previous Mini Project 1/2/3 task).
2. Students should maintain a project log book containing weekly progress of the project
3. At the end of the semester the project group should achieve all the proposed objectives of the problem statement.
4. The work should be completed in all aspects of design, implementation and testing.
5. Project report should be prepared and submitted in soft and hard form along with all the code and datasets.
6. Group should demonstrate the work with various test cases and results obtained and explain future scope.
7. The group should participate in technical symposiums, paper presentations to demonstrate their work and findings in technical community.

Textbooks

1	Nil

References

1	Nil
Useful Links	
1	Nil

CO-PO Mapping														
	Programme Outcomes (PO)												**PSO**	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2												3	3
CO2	2	3											3	3
CO3		2		3	2								2	
CO4	2										3			3
The strength of mapping is to be written as 1,2,3; where, 1: Low, 2: Medium, 3: High Each CO of the course must map to at least one PO, and preferably to only one PO.														

Assessment				
There are three components of lab assessment, LA1, LA2 and Lab ESE. IMP: Lab ESE is a separate head of passing.(min 40 %), LA1+LA2 should be min 40%				
Assessment	**Based on**	**Conducted by**	**Typical Schedule**	**Marks**
LA1	Lab activities, attendance, journal	Lab Course Faculty	During Week 1 to Week 8 Marks Submission at the end of Week 8	30
LA2	Lab activities, attendance, journal	Lab Course Faculty	During Week 9 to Week 16 Marks Submission at the end of Week 16	30
Lab ESE	Lab activities, journal/ performance	Lab Course Faculty and External Examiner as applicable	During Week 18 to Week 19 Marks Submission at the end of Week 19	40
Week 1 indicates starting week of a semester. Lab activities/Lab performance shall include performing experiments, mini-project, presentations, drawings, programming, and other suitable activities, as per the nature and requirement of the lab course. The experimental lab shall have typically 8-10 experiments and related activities if any.				

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Course Information	
Programme	B.Tech. (Computer Science and Engineering)
Class, Semester	Third Year B. Tech., Sem VI
Course Code	5HS301
Course Name	Humanities 2- German Language
Desired Requisites:	10+2 level English

Teaching Scheme		**Examination Scheme (Marks)**			
Practical		**LA1**	**LA2**	**Lab ESE**	**Total**
Interaction	3 Hrs/ Week	30	30	40	100
		Credits: 3			

Course Objectives

1	To learn colloquial German language
2	Enable students to communicate in day to day situations

Course Outcomes (CO) with Bloom's Taxonomy Level

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

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Description**
CO1	Communicate clearly in different scenarios	III	Applying
CO2	Handle oral and written communications independently	II	Understanding

List of Experiments / Lab Activities/Topics

List of Topics(Applicable for Interaction mode):

Module 1: Sentence structure and vocabulary building

1. Alphabet
2. Personal pronouns
3. German articles
4. Genders
5. Plural forms
6. Nouns

Module 2:

1. Date and days of week
2. Names of month
3. Numbers 1 to 1000
4. Names of Continents, Countries and their Capitals
5. Languages and Nationalities, main cultural festivals
6. Health and parts of body.

Module 3:

1. To introduce oneself and others
2. Greeting people/colleagues at office/work-place etc.
3. Exchanging information about country of origin
4. Place of residence, professions

Module 4: Grammar

1. Forming questions
2. Prepositions
3. Conjunctions
4. Verbs
5. Dative and Accusative forms with examples
6. Opposite

Module 5: Oral Communication

1. Asking for and telling telephone numbers with dial code numbers.
2. Making request
3. Word order in sentences/statements and full question.
4. Adding question tags.
5. Speak on given topic.
6. Asking questions

Module 6: Written communication: Basic writing skills

1. Paragraph writing
2. Comprehension
3. Short easy writing
4. Filling in personal information
5. Writing emails and short messages

Textbooks	
1	Hartmut Auf der Strasse, Heiko Bock, Mechthild Gerdes, Jutta Mueller, Helmut Mueller, "Themen Aktuell 1- Deutsch als Fremdsprache-Kursbuch", Max Hueber Verlag, Munich, Germany and Langers International Pvt.Ltd., New Delhi ,ISBN: 3-19-00016909, Reprint 2014
2	Hartmut Auf der Strasse, Heiko Bock, Mechthild Gerdes, Jutta Mueller, Helmut Mueller, "Themen Aktuell1- Deutsch als Fremdsprache-Arbeitsbuch", Max Hueber Verlag, Munich, Germany and Langers International Pvt.Ltd., New Delhi ,ISBN: 3-19-0116903, Reprint 201
3	Alan B, Jones A."Themen Aktuell 1- Deutsch als Fremdsprache - Glossar",Max Hueber Verlag, Munich, Germany and Langers International Pvt.Ltd., New Delhi ,ISBN: 3-19-0001690-9, Reprint 2014
4	

References	
1	Archana Gogate, "German Workbook", Shubhasha Publications, Pune, Reprint July 2016

2	Stefanie Dengler, Paul Rusch, Helen Schmitz, Tanja Sieber, "Netzwerk A1- Deutsch als FremdspracheKursbuch " Klett Langenscheidt, Munich, Germany and GOYAL Publishers Pvt. Ltd., New Delhi, First Indian edition-2015
3	Stefanie Dengler, Paul Rusch, Helen Schmitz,Tanja Sieber, "Netzwerk A1- Deutsch als Fremdsprache Arbeitsbuch ",Klett Langenscheidt, Munich, Germany and GOYAL Publishers Pvt.Ltd., New Delhi, First Indian edition-2015
4	Stefanie Dengler, Paul Rusch, Helen Schmitz, Tanja Sieber, Gavin Schalliol"Netzwerk A1- Deutsch aistremdsprache. Glossar ", Klett Langenscheidt, Munich, Germany and GOYAL Publishers Pvt.Ltd., New Delhi, First Indian edition-2015
Useful Links	
1	www.klett-sprachen.de/netzwerk
2	http://uztranslation.net.ru

CO-PO Mapping

	Programme Outcomes (PO)												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1										1				
CO2										1				

The strength of mapping is to be written as 1,2,3; where, 1: Low, 2: Medium, 3: High
Each CO of the course must map to at least one PO, and preferably to only one PO.

Assessment

There are three components of lab assessment, LA1, LA2 and Lab ESE.
IMP: Lab ESE is a separate head of passing.(min 40 %), LA1+LA2 should be min 40%

Assessment	Based on	Conducted by	Typical Schedule	Marks
LA1	Lab activities, attendance, journal	Lab Course Faculty	During Week 1 to Week 8 Marks Submission at the end of Week 8	30
LA2	Lab activities, attendance, journal	Lab Course Faculty	During Week 9 to Week 16 Marks Submission at the end of Week 16	30
Lab ESE	Lab activities, journal/ performance	Lab Course Faculty and External Examiner as applicable	During Week 18 to Week 19 Marks Submission at the end of Week 19	40

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

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Course Information	
Programme	B.Tech. (Computer Science and Engineering)
Class, Semester	Third Year B. Tech., Sem VI
Course Code	5CS331
Course Name	Elective 3: Remote Sensing & Geographic Information System
Desired Requisites:	Fundamentals of Image processing

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	2 Hrs/week	**MSE**	**ISE**	**ESE**	**Total**
Tutorial	-	30	20	50	100
		Credits: 2			

Course Objectives	
1	To introduce the fundamentals of Remote Sensing (RS) and geographical information systems (GIS)
2	To explore various Remote Sensing satellites, their characteristics and data products
3	To inculcate advantages, limitations and interdisciplinary applications of RS and GIS

Course Outcomes (CO) with Bloom's Taxonomy Level

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

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Description**
CO1	Explain fundamental concepts of RS and GIS	II	Understand
CO2	Interpret and Apply various satellite sensor data and data products	III	Apply
CO3	Demonstrate GIS data and GIS database management system	III	Apply
CO4	Compare and Analyze RS and GIS data using modern tools and techniques	IV	Analyze
CO5	Select and Verify suitable RS and GIS data and data products to design solution for various interdisciplinary problems using RS and GIS tools and techniques	V	Evaluate

Module	**Module Contents**	**Hours**
I	**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.	5
II	**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	4
III	**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	4
IV	**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, GPS, Introduction to ArcGIS	5

V	**GIS Data** Introduction, GIS Data types and Data Representation, Data Acquisition, Georeferencing of GIS Data, Raster and Vector data, Remote Sensing Data in GIS, GIS Database and Database Management System	4
VI	**Spatial Data Analysis** Measurements in GIS-Lengths, Perimeters, and Areas, Queries, Reclassification, Buffering and Neighborhood Functions, Map Overlay, Spatial Interpolation	4

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

Useful Links	
1	https://nptel.ac.in/noc/courses/noc19/SEM1/noc19-ce08
2	https://nptel.ac.in/noc/courses/noc18/SEM1/noc18-ce10
3	https://www.usgs.gov
4	https://bhuvan.nrsc.gov.in/bhuvan_links.php#

CO-PO Mapping

	Programme Outcomes (PO)												**PSO**	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2													
CO2	3												2	
CO3	3												2	
CO4		2			3								3	3
CO5			2		2								3	2

The strength of mapping is to be written as 1: Low, 2: Medium, 3: High
Each CO of the course must map to at least one PO.

Assessment

The assessment is based on MSE, ISE and ESE.
MSE shall be typically on modules 1 to 3.
ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO.
ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6.
For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

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Course Information	
Programme	B.Tech. (Computer Science and Engineering)
Class, Semester	Third Year B. Tech., Sem VI
Course Code	5CS332
Course Name	Elective 3: Advanced Computer Network
Desired Requisites:	Computer Networks

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	2 Hrs/week	**MSE**	**ISE**	**ESE**	**Total**
Tutorial	-	30	20	50	100
		Credits: 2			

Course Objectives	
1	Build an understanding of the fundamental concepts of wireless, mobile, ad hoc and Wireless Sensor Networks.
2	Develop an understanding of different components of computer networks, various protocols, routing algorithms, modern technologies and their applications.
3	Introduce the students to advanced networking concepts such as DWDM, WSNs, ATM and MPLS.
4	Allow the student to gain expertise in some specific areas of networking such as Network designing and Management.

Course Outcomes (CO) with Bloom's Taxonomy Level

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

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Description**
CO1	Understand fundamental concepts of Wireless, Mobile, Ad Hoc, Sensor, Optical and ATM networks operation	II	Understand
CO2	Choose appropriate protocol for desired communication service	III	Apply
CO3	Compare various types of routing protocols	IV	Analyse
CO4	Evaluate advanced network technologies and network protocols	V	Evaluate

Module	**Module Contents**	**Hours**
I	**Wireless and Mobile Networks** Wired communication system, wireless communication system- paging system, cordless telephone system, cellular mobile system, Bluetooth. Wireless Local Area Network (WLAN), Wireless Generations-1G, 2G, 2.5G, 3G, 4G, 5G. Introduction to Cellular mobile Systems-GSM, CDMA. Cellular system design fundamental.	5
II	**Ad Hoc and Wireless Sensor Networks** Ad Hoc Networks-Elements of Ad hoc Wireless Networks, Issues in Ad hoc wireless networks, Example commercial applications of Ad hoc networking, Ad hoc wireless Internet, Issues in Designing a Routing Protocol for Ad Hoc Wireless Networks, Classifications of Routing Protocols, Table Driven Routing Protocols - Destination Sequenced Distance Vector (DSDV), On–Demand Routing protocols –Ad hoc On–Demand Distance Vector Routing (AODV). Wireless Sensor Networks- Challenges for Wireless Sensor Networks, Enabling Technologies for Wireless Sensor Networks, WSN application examples, Network Architecture	5

III	**Optical Networking** SONET/SDH standards, Dense Wavelength division multiplexing (DWDM), Performance and design Considerations	4
IV	**ATM: The WAN Protocol** Faces of ATM, ATM Protocol operations (ATM cell and Transmission) ATM Networking basics, Theory of Operations, B-ISDN reference model, PHY layer, ATM Layer (Protocol model), ATM layer and cell, Traffic Descriptor and parameters, Traffic Congestion control defined, AAL Protocol model, Traffic contract and QoS, User Plane overview, Control Plane AAL, Management Plane, Sub-DS3 ATM, ATM public services.	5
V	**Routing in the Internet** Routing in the Internet: Intra and inter domain routing; Unicast Routing Protocols: RIP, OSPF, BGP; Multicast Routing Protocols: MOSPF, DVMRP, Drawbacks of traditional routing methods, Idea of TE, TE and Different Traffic classes. IP over ATM, Multi-protocol Label switching (MPLS), Storage Area Networks (SAN).	5
VI	**Network Management** SNMP: Concept, Management Components, SMI, MIB, SNMP format, Messages, Backbone Network Design: Backbone Requirements, Network Capacities Topologies, Topologies Strategies, Tuning Network.	4

Textbooks	
1	Darren L Spohn, "Data Network Design", TMH
2	Clint Smith and Daniel Collins , "Wireless networks : design and integration for LTE, EVDO, HSPA, and WiMAX" , McGraw-Hill Education

References	
1	"Computer Networking: A Top-Down Approach featuring the Internet", 3e by James F.Kurose.
2	Peterson and Davie, Computer Networks: A Systems Approach, Morgan Kaufman, 2003, 3rd edition (ISBN: 155860832X).
3	"Ad Hoc Wireless Networks Architectures and Protocols", by C. Siva Ram Murthy, B.S. Manoj

Useful Links	
1	https://www.youtube.com/watch?app=desktop&v=sFhQzxAZzrw
2	https://www.youtube.com/watch?v=Sz1PThotOUQ
3	https://www.youtube.com/watch?v=BuIWNecUAE8

CO-PO Mapping

	Programme Outcomes (PO)												**PSO**	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	2	-	-	-	-	-	-	-	-	-	-	3	2
CO2	3	3	-	-	-	-	-	-	-	-	-	-	3	2
CO3	3	2	3	-	-	-	-	-	-	-	-	-	3	2
CO4	3	2	3	-	-	-	-	-	-	-	-	-	3	2

The strength of mapping is to be written as 1: Low, 2: Medium, 3: High
Each CO of the course must map to at least one PO.

Assessment

The assessment is based on MSE, ISE and ESE.
MSE shall be typically on modules 1 to 3.
ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO.
ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6.
For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

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AY 2022-23

Course Information	
Programme	B.Tech. (Computer Science and Engineering)
Class, Semester	Third Year B. Tech., Sem VI
Course Code	5CS333
Course Name	Elective 3: Deep Learning
Desired Requisites:	Working knowledge of Linear Algebra, Statistics and Probability Theory

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	2 Hrs/week	**MSE**	**ISE**	**ESE**	**Total**
Tutorial	-	30	20	50	100
		Credits: 2			

Course Objectives	
1	To explain the fundamentals of neural networks, recurrent neural networks (RNN), long short term memory cells and convolutional neural networks (CNN).
2	To demonstrate various learning models for practical application.
3	To discuss CNN, RNN and Generative model according to accuracy and speed evaluation parameter's

Course Outcomes (CO) with Bloom's Taxonomy Level

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

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Description**
CO1	Illustrate fundamentals of deep learning using foundation of mathematics terminology	II	Understanding
CO2	Compare various deep learning models by hyper tuning various parameters	IV	Analyzing
CO3	Demonstrate various case studies of deep learning.	III	Applying
CO4	Design and deploy deep learning models on various frameworks and platform.	VI	Creating

Module	**Module Contents**	**Hours**
I	**Introduction to Deep Learning** 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	5
II	**Parameterized Learning and Optimization Methods** 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	4
III	**Convolutional Neural Networks (CNN)** 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	5
IV	**Deep learning-based object detection** Fundamentals of Object detection, Family of R-CNN, Single shot detectors (SSD), Family of You only look once (YOLO)	4

V	**Sequence Models** Recurrent Neural Networks, Vanishing gradients, Gated Recurrent Units (GRU), Long-short-term-memories (LSTMs), Transformer, Bidirectional Encoder Representations from Transformers (BERT)	4
VI	**Generative Models** Autoencoders, Variational Autoencoders, Generative Adversarial Networks	4

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

Useful Links	
1	https://nptel.ac.in/courses/106/106/106106184/
2	https://www.coursera.org/specializations/deep-learning
3	Google Colab: https://colab.research.google.com/
4	Transformer: https://huggingface.co/course/chapter1/1?fw=pt

CO-PO Mapping

	Programme Outcomes (PO)												**PSO**	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2	--	--	--	--	--	--	--	--	--	--	--	--	--
CO2	--	2	--	1	--	--	--	--	--	--	--	--	--	--
CO3	--	--	2	--	--	--	--	--	--	--	--	--	--	1
CO4	--	--	3	--	1	--	--	--	--	--	--	--	--	2

The strength of mapping is to be written as 1: Low, 2: Medium, 3: High
Each CO of the course must map to at least one PO.

Assessment

The assessment is based on MSE, ISE and ESE.
MSE shall be typically on modules 1 to 3.
ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO.
ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6.
For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

Walchand College of Engineering, Sangli

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AY 2022-23

Course Information	
Programme	B.Tech. (Computer Science and Engineering)
Class, Semester	Third Year B. Tech., Sem VI
Course Code	5CS334
Course Name	Elective 3: Soft Computing
Desired Requisites:	

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	2 Hrs/week	**MSE**	**ISE**	**ESE**	**Total**
Tutorial	-	30	20	50	100
		Credits: 2			

Course Objectives	
1	Understand comparative performance of soft and hard computing approaches.
2	Provide to students a sound foundation of mathematical, scientific and engineering principles to formulate, solve and analyse learning problems using soft computing.
3	Imbibe capability for innovation in soft computing.
4	Understand hybrid applications of ANN, Fuzzy and GA

Course Outcomes (CO) with Bloom's Taxonomy Level

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

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Description**
CO1	Interpret soft computing schemes using knowledge of discrete mathematics, data structures, theory of computer science and computer architectures.	II	Understand
CO2	Demonstrate machine learning processes.	III	Apply
CO3	Compare and analyse soft computing schemes.	IV	Analyze
CO4	Design schemes using soft computing	VI	Create
CO5	Evaluate various schemes of soft computing	V	Evaluate

Module	**Module Contents**	**Hours**
I	**Module 1 Fundamentals of Neural Networks** Basics: Human Brain, Model of Artificial Neuron, Neural Network Architectures, Characteristics of Neural Networks, Learning Methods; McCulloch-Pitts model.	4
II	**Back propagation Networks (BPN)** BPN Architecture, Back propagation learning, applications: Parity Problem, Encoder Decoder, NETtalk and DEC-talk, Character Recognition, Cognitron; CNN, RCNN.	5
III	**Unsupervised Learning** Introductions, ARTI Architecture, ART1 Algorithm, Applications of ART1	4
IV	**Fuzzy Systems** Fuzzy logic: Fuzzy Quantifiers, Fuzzy Inference; Fuzzy Rule Based System; Defuzzification Methods, Applications.	4
V	**Genetic Algorithm** Fundamentals: Biological background, Creation of Offsprings, Working Principle, Encoding, Reproduction ; Mathematical Foundations; Data Structure: Mutation, Crossover, Selection; Applications	6

VI	**Hybrid Systems** Integration of neural networks, fuzzy logic and genetic algorithms: Hybrid Systems; Neuro-Fuzzy hybrids, Neuro-Evolutionary Hybrids, Fuzzy-Evolutionary Hybrids, GA-based BPN, Simplified Fuzzy ARTMAP.	3

Textbooks	
1	"Neural Networks, Fuzzy Logic and Genetic Algorithms",S. Rajasekaran, G.A.VijayalakshmiPai, PHI (ECE).
References	
1	MIT-OCW
2	Hertz, Krogh, Palmer"Introduction to the Theory of Neural Computation"
3	B. Yegnanarayana, PHI, "Artificial Neural Networks"
4	David E. Goldberg, Addison Wesley, "Genetic Algorithms"
Useful Links	
1	https://cse.iitkgp.ac.in/~dsamanta/courses/sca/index.html

CO-PO Mapping

	Programme Outcomes (PO)												**PSO**	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2													
CO2			3										3	
CO3		3		2										
CO4			3										3	

The strength of mapping is to be written as 1: Low, 2: Medium, 3: High
Each CO of the course must map to at least one PO.

Assessment

The assessment is based on MSE, ISE and ESE.
MSE shall be typically on modules 1 to 3.
ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO.
ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6.
For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

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AY 2022-23

Course Information

Programme	B.Tech. (Computer Science Engineering)
Class, Semester	Third Year B. Tech., Sem VI
Course Code	5CS372
Course Name	Elective 4 Lab: Software Engineering Tools Laboratory
Desired Requisites:	Software Engineering SDLC, Project Management, Agile Methodology

Teaching Scheme		**Examination Scheme (Marks)**			
Practical	4 Hrs/ Week	**LA1**	**LA2**	**Lab ESE**	**Total**
Interaction	-	30	30	40	100
		Credits: 2			

Course Objectives

1	To Understand the Software Development dearth and Tools practiced in the 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 Outcomes (CO) with Bloom's Taxonomy Level

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

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Description**
CO1	Be familiar with open source software development tools currently used in the industry.	II	Understand
CO2	Utilize open source software for developing a variety of software applications, particularly Web applications.	III	Apply
CO3	Get acquainted with the use of software tools to achieve quality and industry readiness.	VI	Create

List of Experiments / Lab Activities/Topics

List of Topics(Applicable for Interaction mode):

List of Lab Activities:

1. Overview of FOSS.
2. Study of different software development frameworks.
3. Study of project management tools (e.g Jira).
4. Understanding version control using VSS.
5. Managing code using SVN.
6. Performing Functional testing
7. Performing regression testing
8. Performing performance testing
9. Study of Deployment and Integration tools.
10. Study of various software engineering tools (e.g CircleCI, Maven, Gradle).

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)

Useful Links	
1	https://www.javatpoint.com/software-engineering-case-tools-for-software-metrics
2	https://www.javatpoint.com/github
3	https://www.javatpoint.com/software-testing-tutorial

CO-PO Mapping

	Programme Outcomes (PO)												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2	2											1	
CO2					2									
CO3				2		2								2

The strength of mapping is to be written as 1,2,3; where, 1: Low, 2: Medium, 3: High
Each CO of the course must map to at least one PO, and preferably to only one PO.

Assessment

There are three components of lab assessment, LA1, LA2 and Lab ESE.
IMP: Lab ESE is a separate head of passing.(min 40 %), LA1+LA2 should be min 40%

Assessment	Based on	Conducted by	Typical Schedule	Marks
LA1	Lab activities, attendance, journal	Lab Course Faculty	During Week 1 to Week 8 Marks Submission at the end of Week 8	30
LA2	Lab activities, attendance, journal	Lab Course Faculty	During Week 9 to Week 16 Marks Submission at the end of Week 16	30
Lab ESE	Lab activities, journal/ performance	Lab Course Faculty and External Examiner as applicable	During Week 18 to Week 19 Marks Submission at the end of Week 19	40

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

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AY 2022-23

Course Information

Programme	B.Tech. (Computer Science Engineering)
Class, Semester	Third Year B. Tech., Sem VI
Course Code	5CS373
Course Name	Elective 4 Lab: Advanced Web and Mobile Application Development Lab
Desired Requisites:	Programming Lab-3

Teaching Scheme		**Examination Scheme (Marks)**			
Practical	4 Hrs/ Week	**LA1**	**LA2**	**Lab ESE**	**Total**
Interaction	-	30	30	40	100
		Credits: 2			

Course Objectives

1	to inculcate understanding of state-of-the-art front-end and back-end development frameworks of web programming and mobile app development tools.
2	to introduce selection of appropriate concepts from different state-of-the-art frameworks/libraries and tools for developing a web and mobile app.
3	to infuse skills of combining different components from state-of-the-art technologies to design a web and mobile app to solve real world problems.

Course Outcomes (CO) with Bloom's Taxonomy Level

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

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Description**
CO1	summarize the concepts of various state-of-the-art front-end, back-end web and mobile app development technologies & frameworks.	II	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.	III	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.	IV	Analysing
CO4	select appropriate front-end, back-end web and mobile app development technologies, frameworks, tools and their components to solve real-world problems.	V	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.	VI	Creating

List of Experiments / Lab Activities/Topics

List of Topics(Applicable for Interaction mode):

List of Lab Activities:

Module 1: Web Application Framework/Library – Part 1

State-of-the-art Front-End Framework library: One of the following technologies will be considered:Angular, React.js or other state-of-the-art front-end development framework/library.

Experiments:

1. Installing framework and configuring Integrated Development Environment (IDE), and its dependencies.
2. Creating workspace, project and setting up the necessary environment.
3. Implementing the fundamental syntaxes and components of the framework.
4. Building and testing the application.
5. Deploying the application.

Module 2: Web Application Framework/Library – Part 2

State-of-the-art Front-End Framework library: One of the following technologies will be considered:Meteor.js, Vue.js or other state-of-the-art front-end development framework/library.

Experiments:

1. Installing framework and configuring Integrated Development Environment (IDE), and its dependencies.
2. Creating workspace, project and setting up the necessary environment.
3. Implementing the fundamental syntaxes and components of the framework.
4. Building and testing the application.
5. Deploying the application.

Module 3: Server-side Development Framework/Library – Part 1

State-of-the-art server-side Technology: Ruby on Rails, Flask or other state-of-the-art back-end development framework/library.

Experiments:

1. Installing framework and configuring Integrated Development Environment (IDE), and its dependencies.
2. Creating workspace, project and setting up the necessary environment.
3. Implementing the fundamental syntaxes and components of the framework.
4. Implementing server-side validations and authentication for web application.
5. Implementing CRUD operations for web application.
6. Building and testing the application.
7. Deploying the application.

Module 4: Server-side Development Framework/Library – Part 2

State-of-the-art server-side Technology: Django or another state-of-the-art framework/library.

Experiments:

1. Installing framework and configuring Integrated Development Environment (IDE), and its dependencies.
2. Creating workspace, project and setting up the necessary environment.
3. Implementing the fundamental syntaxes and components of the framework.
4. Implementing server-side validations and authentication for web application.
5. Implementing CRUD operations for web application.
6. Building and testing the application.
7. Deploying the application.

Module 5: Mobile App Development

Introduction to App Development, Introduction to Android App Development, Installation and configuration of IDE, Activities, Intents and Intent Filters, UI and Navigation, Camera, Connectivity to database, Web-based content, debugging and testing the app, and publishing the app.

Experiments:

1. Installing and configuring Integrated Development Environment (IDE).
2. Managing the project.
3. Writing the app.
4. Connecting the app to the database.
5. Building and running the app on an emulator and on a hardware device.
6. Configuring, debugging, testing, and profiling the app.
7. Publishing the app on the marketplace.

Module 6: Hosting Web Applications

Building web application and Hosting web application.

Experiments:

1. Choosing a hosting server and selecting a plan for web hosting.
2. Choosing and configuring DNS address.
3. Uploading, configuring and running the website over the internet.

Textbooks	
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	
1	Dawn Griffiths, David Griffiths, “Head First Android Development”, O’Reilly Media, 2nd Edition, 2017, ISBN: 9781491974056
2	Rick Boyer, “Android 9 Development Cookbook: Over 100 recipes and solutions to solve the most common problems faced by Android developers”, Packt Publishing Limited, 3rd Edition, 2018, ISBN-13: 978-1788991216
3	Felipe Coury, Ari Lerner, Carlos Taborda, “ng-book: The Complete Guide to Angular”, Create Space Independent Publishing Platform, 5th Edition, 2018, ISBN-13: 978-1985170285
Useful Links	
1	www.w3schools.com
2	https://developer.android.com/docs
3	Official framework websites for Documentation/Help

CO-PO Mapping														
	Programme Outcomes (PO)												**PSO**	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2	1												1
CO2	3	2	2	3										2
CO3		3		2										1
CO4		2		2										1
CO5			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, and preferably to only one PO.														

Assessment				
There are three components of lab assessment, LA1, LA2 and Lab ESE. IMP: Lab ESE is a separate head of passing.(min 40 %), LA1+LA2 should be min 40%				
Assessment	**Based on**	**Conducted by**	**Typical Schedule**	**Marks**
LA1	Lab activities, attendance, journal	Lab Course Faculty	During Week 1 to Week 8 Marks Submission at the end of Week 8	30
LA2	Lab activities, attendance, journal	Lab Course Faculty	During Week 9 to Week 16 Marks Submission at the end of Week 16	30
Lab ESE	Lab activities, journal/ performance	Lab Course Faculty and External Examiner as applicable	During Week 18 to Week 19 Marks Submission at the end of Week 19	40

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

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Course Information	
Programme	B.Tech. (Computer Science and Engineering)
Class, Semester	Third Year B. Tech., Sem VI
Course Code	5OE378
Course Name	Open Elective-3: Fundamentals of IOT
Desired Requisites:	Basic programming knowledge

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	2 Hrs/week	**MSE**	**ISE**	**ESE**	**Total**
Tutorial	-	30	20	50	100
		Credits: 2			

Course Objectives	
1	To illustrate the basic concepts of Internet of Things.
2	To illustrate basic concepts of IIOT.
3	To demonstrate Working of IOT devices.

Course Outcomes (CO) with Bloom's Taxonomy Level

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

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Description**
CO1	Explain how to design and develop Applications in IOT.	III	Apply
CO2	To Illustrate how IOT devices works	III	Apply
CO3	To access different operations using IOT applications.	V	Evaluate
CO4	To produce a program to solve a real-world problem.	VI	Create

Module	**Module Contents**	**Hours**
I	Introduction to Internet of Things Introduction, Physical design of IOT, Logical Design of IOT,IOT Enabling Technology, Sensing, Actuation	4
II	Basics of IOT Networking Introduction to Networking, IOT Network Protocols, Connectivity Technology	5
III	IOT and Communication Protocols Communication Protocols, Sensor Networks, Machine-to-Machine Communications .	5
IV	Interoperability in IoT Introduction to Arduino Programming, Introduction to Python programming, Introduction to Raspberry Pi, Implementation of IoT with Raspberry Pi.	4
V	Industrial IoT Introduction to IIOT,AWS-IOT, Introduction to Lora-wan, Node MCU IOT Platform	4
VI	Case Study Agriculture, Health care, Smart city, Activity Monitoring, Energy, Environment	4

Textbooks

1	S. Misra, A. Mukherjee, and A. Roy, 2020. Introduction to IoT. Cambridge University Press.
2	S. Misra, C. Roy, and A. Mukherjee, 2020. Introduction to Industrial Internet of Things and Industry 4.0. CRC Press.
3	Research Papers

References	
1	Arashdeep Bahga ,Vijay Madisetti Internet of Things an Hands on Approach,University Press.
Useful Links	
1	https://onlinecourses.nptel.ac.in/noc21_cs17

CO-PO Mapping														
	Programme Outcomes (PO)												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1		2	3											2
CO2	1		2											2
CO3	1	2	2											2
CO4		2	1											1
The strength of mapping is to be written as 1: Low, 2: Medium, 3: High Each CO of the course must map to at least one PO.														

Assessment
The assessment is based on MSE, ISE and ESE. MSE shall be typically on modules 1 to 3. ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO. ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6. For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

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Course Information	
Programme	B.Tech. (Computer Science and Engineering)
Class, Semester	Third Year B. Tech., Sem VI
Course Code	5OE379
Course Name	Open Elective-4: Artificial Intelligence and Machine Learning
Desired Requisites:	Introductory Programming knowledge, Probability and statistics

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	3 Hrs/week	**MSE**	**ISE**	**ESE**	**Total**
Tutorial	-	30	20	50	100
		Credits: 3			

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

Course Outcomes (CO) with Bloom's Taxonomy Level

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

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Description**
CO1	Illustrate AI and ML Problems and its simple solutions.	III	Apply
CO2	Compare simple solutions for AI and ML problems.	IV	Analyze
CO3	Classify various AI and ML problem solving schemes.	V	Evaluate

Module	**Module Contents**	**Hours**
I	**Introduction to AI and Problem Solving** Introduction, History, Application, Approaches, Problem solving by searching, Constraint satisfaction problems.	7
II	**Knowledge Representation, Logic and Reasoning** Propositional Logic, Inference rules, First Order Logic, Rule based systems, Reasoning with uncertainty, Fuzzy reasoning, Bayes networks.	7
III	**Expert Systems** ES Characteristics, Architecture, Rule based ES, Rule Induction, Introduction to Natural Language Processing.	6
IV	**Introduction to Machine Learning** Introduction to Machine Learning, Concepts of Supervised and Unsupervised Learning,Linear and Multivariate Regression.	6
V	**Classification and Unsupervised learning** Decision Trees, Logistic regression, Unsupervised learning-Clustering, K-means clustering, Dimensionality Reduction-PCA.	7
VI	**Evaluation Measures and Reinforcement learning** Evaluation Measures, ROC curve, Introduction to reinforcement learning, Case Study.	6

Textbooks

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

References	
1	NPTEL course on Introduction to AI.
2	NPTEL course on Introduction to Machine Learning.
Useful Links	
1	Artificial Intelligence Search Methods for Problem Solving (SWAYAM): https://onlinecourses.nptel.ac.in/noc21_cs79/preview
2	Introduction to Artificial Intelligence (AI) (Coursera): https://www.coursera.org/learn/introduction-to-ai
3	https://ai.google/education/
4	Machine Learning by Stanford (Andrew Ng) on Coursera: https://www.coursera.org/learn/machine-learning
5	Introduction to Machine Learning – IITM (SWAYAM) https://onlinecourses.nptel.ac.in/noc21_cs70/preview

CO-PO Mapping

	Programme Outcomes (PO)												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3												1	
CO2		3											1	
CO3		3											1	

The strength of mapping is to be written as 1: Low, 2: Medium, 3: High
Each CO of the course must map to at least one PO.

Assessment

The assessment is based on MSE, ISE and ESE.
MSE shall be typically on modules 1 to 3.
ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO.
ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6.
For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

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Course Information

Programme	B.Tech. (Computer Science and Engineering)
Class, Semester	Final Year B. Tech., Sem VII
Course Code	5CS401
Course Name	Cryptography and Network Security
Desired Requisites:	Computer Networks

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	3 Hrs/week	**MSE**	**ISE**	**ESE**	**Total**
Tutorial	-	30	20	50	100
		Credits: 3			

Course Objectives

1	Understand OSI security architecture and classical encryption techniques.
2	Acquire fundamental knowledge on the concepts of finite fields and number theory.
3	Understand various block cipher and stream cipher models.
4	Describe the principles of public key cryptosystems, hash functions and digital signature.

Course Outcomes (CO) with Bloom's Taxonomy Level

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

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Description**
CO1	Apply the number theory concepts to different encryption and decryption techniques to solve problems related to confidentiality and authentication.	III	Apply
CO2	Analyze security of network protocols and systems	IV	Analyze
CO3	Justify various methods of authentication and access control for application of technologies to various sections of industry and society.	V	Evaluate
CO4	Identify and classify security threats and develop a security model to prevent, detect and recover from attack	VI	Create

Module	**Module Contents**	**Hours**
I	**INTRODUCTION** 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– Entity Authentication: Passwords, challenge-response algorithms, zero-knowledge protocols, Authentication applications – Kerberos, X.509.	6
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

Textbooks	
1	William Stallings, *“Cryptography and Network Security: Principles and Practice”,* Prentice Hall of India.
2	Behrouz A. Forouzan “*Cryptography And Network Security*”. Tata Mcgraw-Hill, New Delhi India.

References	
1	“Applied Cryptography, Protocols Algorithms and Source Code in C”, Bruce Schneier, Wiley.
2	“Cryptography and Network Security”, Atul Kahate, Tata Mc Graw Hill.
3	Alfred J. Menezes, Paul C. van Oorschot and Scott A. Vanstone, “Handbook of Applied Cryptography”, CRC Press.
4	Johannes A. Buchmann, *“Introduction to Cryptography”,* Springer.

Useful Links	
1	

CO-PO Mapping

	Programme Outcomes (PO)												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	3											2	2
CO2	3	2											3	2
CO3	3	3											3	3
CO4	3	2											3	1

The strength of mapping is to be written as 1: Low, 2: Medium, 3: High

Each CO of the course must map to at least one PO.

Assessment

The assessment is based on MSE, ISE and ESE.
MSE shall be typically on modules 1 to 3.
ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO.
ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6.
For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

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Course Information	
Programme	B.Tech. (Computer Science and Engineering)
Class, Semester	Final Year B. Tech., Sem VII
Course Code	5CS403
Course Name	Humanities 4-Legal, IPR, Safety
Desired Requisites:	Nil

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	1 Hrs/week	**MSE**	**ISE**	**ESE**	**Total**
Tutorial	-	15	10	25	50
		Credits: 1			

Course Objectives	
1	To introduce the students about Legal, IPR, Safety laws.
2	To disseminate knowledge on patents, patent regime in India and abroad and registration aspects.
3	To be aware about current trends in IPR and Govt. steps in fostering IPR.

Course Outcomes (CO) with Bloom's Taxonomy Level

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

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Description**
CO1	Understand about Indian industry Legal, IPR, Safety laws.	II	Understanding
CO2	Interpret patent and copyright in innovative research work.	III	Applying
CO3	Illustrate the importance of Indian industry Legal, IPR, Safety laws	IV	Analyzing

Module	**Module Contents**	**Hours**
I	Overview of Bureau of Indian Standards Act of 1986	2
II	The Right to Information Act of 2005, In order to promote public education and public safety.	2
III	Intellectual Property, Patents, Copyrights, Trademarks.	3
IV	Other forms of IP, Current Contour.	2
V	Information technology Act 2008,Cyber laws.	3
VI	IT Laws and Regulations in Connection with IPR.	1

Textbooks

1	Nithyananda, K V. (2019). Intellectual Property Rights: Protection and Management. India, IN:Cengage Learning India Private Limited.
2	Cyber Law by Duggal Pavan

References

1	Ahuja, V K. (2017). Law relating to Intellectual Property Rights. India, IN: Lexis Nexis.

Useful Links

1	Cell for IPR Promotion and Management (http://cipam.gov.in/)
2	https://law.resource.org/pub/in/bis/manifest.med.html
3	World Intellectual Property Organization (https://www.wipo.int/about-ip/en/)
4	Office of the Controller General of Patents, Designs & Trademarks (http://www.ipindia.nic.in/)

CO-PO Mapping														
	Programme Outcomes (PO)												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1								1					1	1
CO2									2				1	1
CO3							1						2	1
The strength of mapping is to be written as 1: Low, 2: Medium, 3: High Each CO of the course must map to at least one PO.														

Assessment
The assessment is based on MSE, ISE and ESE. MSE shall be typically on modules 1 to 3. ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO. ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6. For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

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Course Information	
Programme	B.Tech. (Computer Science and Engineering)
Class, Semester	Final Year B. Tech., Sem VII
Course Code	5CS453
Course Name	Cryptography and Network Security Lab
Desired Requisites:	Computer Networking

Teaching Scheme		**Examination Scheme (Marks)**			
Practical	2 Hrs/ Week	**LA1**	**LA2**	**Lab ESE**	**Total**
Interaction	-	30	30	40	100
		Credits: 1			

Course Objectives	
1	To learn different cipher techniques
2	To implement the algorithms DES, AES, RSA,MD5,SHA-1
3	To use network security tools and vulnerability assessment tools

Course Outcomes (CO) with Bloom's Taxonomy Level

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

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Description**
CO1	Develop code for classical Encryption Techniques to solve the real life problems	III	Apply
CO2	Analyze the network security system using open source tools	IV	Analyze
CO3	Evaluate the securities of different security protocols	V	Evaluate
CO4	Build cryptosystems by applying symmetric and public key encryption algorithms	VI	Create

List of Experiments / Lab Activities/Topics

List of Topics(Applicable for Interaction mode):

List of Lab Activities:

1. Perform encryption, decryption using the following substitution techniques
    a. Ceaser cipher,
    b. playfair cipher
    c. Hill Cipher
    d. Vigenere cipher
2. Perform encryption and decryption using following transposition techniques
    a. Rail fence
    b. row and Column Transformation
3. Implementation of Euclidean and Extended Euclidean Algorithm
4. Implementation of Chinese Remainder Theorem (CRT)
5. Apply DES algorithm for practical applications
6. Apply AES algorithm for practical applications
7. Implementation of RSA Algorithm
8. Implement the Diffie-Hellman Key Exchange algorithm for a given problem
9. Calculate the message digest of a text using the SHA-1 algorithm
10. Implement the SIGNATURE SCHEME – Digital Signature Standard
11. Demonstration of SSL using Wireshark
12. Automated Attack and Penetration Tools
    Exploring a Vulnerability Assessment Tool

In case of mini-projects, drawing, presentations etc, write the relevant details of the same.

Textbooks	
1	William Stallings, *"Cryptography and Network Security: Principles and Practice",* Prentice Hall of India.
2	Behrouz A. Forouzan "*Cryptography And Network Security*". Tata Mcgraw-Hill, New Delhi India.
References	
1	"Applied Cryptography, Protocols Algorithms and Source Code in C", Bruce Schneier, Wiley.
2	"Cryptography and Network Security", Atul Kahate, Tata Mc Graw Hill.
Useful Links	
1	

CO-PO Mapping

	Programme Outcomes (PO)												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3												3	2
CO2	3	3			3								3	1
CO3	3	3		2									3	2
CO4	3	2											3	2

The strength of mapping is to be written as 1,2,3; where, 1: Low, 2: Medium, 3: High
Each CO of the course must map to at least one PO, and preferably to only one PO.

Assessment

There are three components of lab assessment, LA1, LA2 and Lab ESE. IMP: Lab ESE is a separate head of passing.(min 40 %), LA1+LA2 should be min 40%				
Assessment	**Based on**	**Conducted by**	**Typical Schedule**	**Marks**
LA1	Lab activities, attendance, journal	Lab Course Faculty	During Week 1 to Week 8 Marks Submission at the end of Week 8	30
LA2	Lab activities, attendance, journal	Lab Course Faculty	During Week 9 to Week 16 Marks Submission at the end of Week 16	30
Lab ESE	Lab activities, journal/ performance	Lab Course Faculty and External Examiner as applicable	During Week 18 to Week 19 Marks Submission at the end of Week 19	40
Week 1 indicates starting week of a semester. Lab activities/Lab performance shall include performing experiments, mini-project, presentations, drawings, programming, and other suitable activities, as per the nature and requirement of the lab course. The experimental lab shall have typically 8-10 experiments and related activities if any.				

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Course Information

Programme	B.Tech. (Computer science and engineering)
Class, Semester	Final Year B. Tech., Sem VII
Course Code	5CS454
Course Name	Techno-Socio Activity
Desired Requisites:	This is the audit course. No pre-requisite

Teaching Scheme		**Examination Scheme (Marks)**			
Practical	-	**LA1**	**LA2**	**ESE**	**Total**
Interaction	1 Hrs/ Week	15	15	20	50
		Credits: 1			

Course Objectives

1	To nurture technical knowledge mainly through various participations and competitions during their engineering study
2	To develop empathy by participating in social empowerment acts

Course Outcomes (CO) with Bloom's Taxonomy Level

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

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Description**
CO1	To develop professional and soft skills to participations	IV	Analyse
CO2	To analyse real world problem, create and showcase the best solution of techno-socio domains	VI	Create

List of Experiments / Lab Activities/Topics

List of Topics(Applicable for Interaction mode):

List of Lab Activities:

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

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

Textbooks

1	Nil

References

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

Useful Links

1	Nil

CO-PO Mapping														
	Programme Outcomes (PO)												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	--	--	--	--	--	--	--	--	--	--	1	--	--	--
CO2	--	--	--	--	--	--	--	--	--	--	2	--	--	--
CO3	--	--	--	--	--	--	--	--	--	--	--	--	--	--

The strength of mapping is to be written as 1,2,3; where, 1: Low, 2: Medium, 3: High
Each CO of the course must map to at least one PO, and preferably to only one PO.

Assessment

There are three components of lab assessment, LA1, LA2 and Lab ESE.
IMP: Lab ESE is a separate head of passing.(min 40 %), LA1+LA2 should be min 40%

Assessment	Based on	Conducted by	Typical Schedule	Marks
LA1	Lab activities, attendance, journal	Lab Course Faculty	During Week 1 to Week 8 Marks Submission at the end of Week 8	15
LA2	Lab activities, attendance, journal	Lab Course Faculty	During Week 9 to Week 16 Marks Submission at the end of Week 16	15
Lab ESE	Lab activities, journal/ performance	Lab Course Faculty and External Examiner as applicable	During Week 18 to Week 19 Marks Submission at the end of Week 19	20

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

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Course Information	
Programme	B.Tech. (Computer science and engineering)
Class, Semester	Final Year B. Tech., Sem VII
Course Code	5CS491
Course Name	Project-1
Desired Requisites:	Nil

Teaching Scheme		Examination Scheme (Marks)			
Practical	6 Hrs/ Week	**LA1**	**LA2**	**Lab ESE**	**Total**
Interaction	-	30	30	40	100
		Credits: 3			

Course Objectives	
1	To understand Software Development Life Cycle and prepare project proposal based on real life use case
2	To utilize state of the art CASE tools especially for design, development and testing phases.
3	To experience project management techniques.
4	To acquaint the ability to map technical skills to real life applications from customers perspective.

Course Outcomes (CO) with Bloom's Taxonomy Level

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

CO	Course Outcome Statement/s	Bloom's Taxonomy Level	Bloom's Taxonomy Description
CO1	demonstrate the state-of-art technological trends through planning and design project aspects.	II	Understanding
CO2	adopt agile methodology and mature team skills through various SDLC phases.	III	Applying
CO3	showcase the project working model with real life use case mainly to potential customers.	VI	Creating

List of Experiments / Lab Activities/Topics

List of Topics(Applicable for Interaction mode):

List of Lab Activities:

1. Project work is to be carried out in two semesters with group size of maximum three to four students
2. In first semester project group will select a project topic with consent from guide and approval from department and submit the brief document discussing the outline of the project with clear objectives.
3. Students should maintain a project log book containing weekly progress of the project.
4. At the end of the semester project group should complete the system design, Algorithm design and present with suitable model. (CFD, DFD & Data structure layout, SRS & UML diagram using project management tool)
5. Project report should be prepared using Latex and submitted in soft and hard form.

Textbooks	
1	Nil

References	
1	Nil

Useful Links	
1	Nil

CO-PO Mapping														
	Programme Outcomes (PO)												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	--	3	--	2	--	--	--	--	1	--	--	--	--	--
CO2	--	--	3	--	--	--	--	--	--	1	--	--	--	--
CO3	--	--	--	3	--	--	--	--	--	--	--	--	--	--
The strength of mapping is to be written as 1,2,3; where, 1: Low, 2: Medium, 3: High Each CO of the course must map to at least one PO, and preferably to only one PO.														

Assessment				
There are three components of lab assessment, LA1, LA2 and Lab ESE. IMP: Lab ESE is a separate head of passing.(min 40 %), LA1+LA2 should be min 40%				
Assessment	**Based on**	**Conducted by**	**Typical Schedule**	**Marks**
LA1	Lab activities, attendance, journal	Lab Course Faculty	During Week 1 to Week 8 Marks Submission at the end of Week 8	30
LA2	Lab activities, attendance, journal	Lab Course Faculty	During Week 9 to Week 16 Marks Submission at the end of Week 16	30
Lab ESE	Lab activities, journal/ performance	Lab Course Faculty and External Examiner as applicable	During Week 18 to Week 19 Marks Submission at the end of Week 19	40
Week 1 indicates starting week of a semester. Lab activities/Lab performance shall include performing experiments, mini-project, presentations, drawings, programming, and other suitable activities, as per the nature and requirement of the lab course. The experimental lab shall have typically 8-10 experiments and related activities if any.				

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Course Information

Programme	B.Tech. (Computer Science Engineering)
Class, Semester	Final Year B. Tech., Sem VII
Course Code	5CS455
Course Name	Humanities 3-Project Management
Desired Requisites:	Software Engineering

Teaching Scheme		**Examination Scheme (Marks)**			
Practical	-	**LA1**	**LA2**	**ESE**	**Total**
Interaction	1 Hrs/ Week	15	15	20	50
		Credits: 1			

Course Objectives

1	To provide in-depth coverage of project management principles using tools.
2	To Understand the Project management tools practiced in the IT industry.
3	To Comprehend the hands-on exploration of project management tools used on Software Development.

Course Outcomes (CO) with Bloom's Taxonomy Level

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

CO	Course Outcome Statement/s	Bloom's Taxonomy Level	Bloom's Taxonomy Description
CO1	Be familiar with project management concepts used in software development in industry.	II	Understanding
CO2	Utilize project management tools for developing a variety of software applications.	III	Applying
CO3	Get acquainted with the use of project management tools to achieve quality and industry readiness.	VI	Creating

List of Experiments / Lab Activities/Topics

List of Topics(Applicable for Interaction mode):

List of Lab Activities:

1. Overview of Jira software.
2. Study of Project management using Jira.
3. Understanding Workflow management.
4. Managing Tasks using Jira.
5. Jira user and role management.
6. Project Monitoring and Reporting.
7. Issue management using.
8. Bug tracking and reporting.
9. Performing Project Integration.
10. Agile best practices using Jira.
11. Version management using Jira.

Textbooks

1	Jira Project Management A Complete Guide - 2019 by Gerardus Blokdyk . The Art of Service
2	Jira Quick Start Guide: Manage your projects efficiently using the all-new Jira by Ravi Sagar

References

1	JIRA Essentials, Third Edition, Patrick Li,Packt enterprise

Useful Links	
1	https://www.atlassian.com/
2	https://www.javatpoint.com/jira-tutorial

CO-PO Mapping														
	Programme Outcomes (PO)												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2	2											2	
CO2					3									
CO3				2		2								2
The strength of mapping is to be written as 1,2,3; where, 1: Low, 2: Medium, 3: High Each CO of the course must map to at least one PO, and preferably to only one PO.														

Assessment				
There are three components of lab assessment, LA1, LA2 and Lab ESE. IMP: Lab ESE is a separate head of passing.(min 40 %), LA1+LA2 should be min 40%				
Assessment	**Based on**	**Conducted by**	**Typical Schedule**	**Marks**
LA1	Lab activities, attendance, journal	Lab Course Faculty	During Week 1 to Week 8 Marks Submission at the end of Week 8	30
LA2	Lab activities, attendance, journal	Lab Course Faculty	During Week 9 to Week 16 Marks Submission at the end of Week 16	30
Lab ESE	Lab activities, journal/ performance	Lab Course Faculty and External Examiner as applicable	During Week 18 to Week 19 Marks Submission at the end of Week 19	40
Week 1 indicates starting week of a semester. Lab activities/Lab performance shall include performing experiments, mini-project, presentations, drawings, programming, and other suitable activities, as per the nature and requirement of the lab course. The experimental lab shall have typically 8-10 experiments and related activities if any.				

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Course Information

Programme	B.Tech. (Computer Science and Engineering)
Class, Semester	Final Year B. Tech., Sem VII
Course Code	5CS411
Course Name	Elective-5: High Performance Computing
Desired Requisites:	Data structures, Basic Programming knowledge

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	3 Hrs/week	**MSE**	**ISE**	**ESE**	**Total**
Tutorial	-	30	20	50	100
		Credits: 3			

Course Objectives

1	To be introduced with current trends in parallel computer architectures and programming models (i.e. languages and libraries) for shared memory, many core/multicore architecture.
2	To understand parallel program design methodology. Also to calculate speedup and efficiency of parallel algorithm.
3	To learn various parallel algorithms for matrices, graphs.

Course Outcomes (CO) with Bloom's Taxonomy Level

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

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Description**
CO1	Describe different parallel paradigms, inter connection networks, and tools for parallel programming.	II	Understand
CO2	Demonstrate design methodology and performance measurement of parallel algorithms on various parallel platforms.	III	Apply
CO3	Analyze a given problem for possibilities of parallel computations.	IV	Analyze

Module	**Module Contents**	**Hours**
I	**Introduction** What is parallel computing? The scope of parallel computing? Issues in parallel computing. Taxonomy of parallel architecture, Memory bound vs Compute bound problems, Dynamic interconnection networks, static interconnection networks, Routing mechanism for static network. Communication cost in static interconnection network.	8
II	**Parallel programming models and paradigms** 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, parallel work efficiency, amdahl limiters, communication-computation overlap/pipelining.	8

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, Thread programming C++11 Threads /OpenMP, MPI - two sided communication, one side communication based programming model aka PGAS (Partitioned Global Address Space) eg: OpenSHMEM/NVSHMEM.	6
V	**Parallel programming using accelerators** Introduction of CUDA/OpenCL, Chapel, etc. Basics of GPGPU, CUDA Programming model, CUDA memory type, CUDA and/or OpenCL for GPGPU hardware, case study.	6
VI	**Algorithms** Dense matrix algorithms, sorting, graph algorithms, prefix sum with decoupled lookback, parallel radix sort/batcher's sort	6

Textbooks	
1	"Introduction to Parallel Computing", (2nd ed.), by Ananth Grama, Anshul Gupta, George Karypis, and Vipin Kumar.
2	"High Performance Cluster Computing : Programming and Applications", Volume 2 By Buyya Rajkumar.
3	"CUDA Programming: A Developer's Guide to Parallel Computing with GPUs", by Shane cook "Introduction to PARALLEL PROGRAMMING", by Peter Pacheco.

References	
1	"Parallel Programming in C with MPI and OpenMP", Michael J. Quinn, McGraw-Hill, 2004.

Useful Links	
1	Single-pass Parallel Prefix Scan with Decoupled Look-back https://research.nvidia.com/publication/single-pass-parallel-prefix-scan-decoupled-look-back
2	parallel radix sort/batcher's sort. https://developer.download.nvidia.com/video/gputechconf/gtc/2020/presentations/s21572-a-faster-radix-sort-implementation.pdf
3	High Performance Computing, Charles Severance, 1998. http://cnx.org/content/col11136/latest/
4	MPI: The Complete Reference, Marc Snir, Steve Otto, Steven Huss-Lederman, David Walker, and Jack Dongarra, 1996. http://www.netlib.org/utk/papers/mpi-book/mpi-book.html

CO-PO Mapping

	Programme Outcomes (PO)												**PSO**	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2												1	1
CO2		3											3	1
CO3		2	2										2	1

The strength of mapping is to be written as 1: Low, 2: Medium, 3: High
Each CO of the course must map to at least one PO.

Assessment

The assessment is based on MSE, ISE and ESE.
MSE shall be typically on modules 1 to 3.
ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO.
ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6.
For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

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Course Information	
Programme	B.Tech. (Computer Science and Engineering)
Class, Semester	Final Year B. Tech., Sem VII
Course Code	5CS412
Course Name	Elective-5 : Data Mining
Desired Requisites:	Database Engineering

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	3 Hrs/week	**MSE**	**ISE**	**ESE**	**Total**
Tutorial	-	30	20	50	100
		Credits: 3			

Course Objectives	
1	To gain the knowledge of theoretical background to several of the commonly used data mining techniques.
2	To analyze data, choose relevant models and algorithms for respective applications.
3	To evaluate the different data mining algorithms and tools
4	To develop research interest towards advances in data mining

Course Outcomes (CO) with Bloom's Taxonomy Level

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

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Description**
CO1	**apply** the data pre-processing and data mining algorithms to **solve** real world problems	III	Apply
CO2	**analyze** a complex data mining problem and different data mining algorithms to **identify** solutions.	IV	Analyze
CO3	**measure** the performance of different data mining algorithms/tools, **evaluate** and **recommend** the optimal solution.	V	Evaluate
CO4	**Design** and **build** a data mining tool/solution to meet the given set of computing requirements in the context of the complex data mining problem.	VI	Create

Module	**Module Contents**	**Hours**
I	**Introduction** Data mining and its need, Different kinds of data that can be mined, Various patterns that can be mined, Technologies to be Used, Target applications, Major Issues in Data Mining.	5
II	**About Data and its pre-processing** 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

Textbooks	
1	Jiawei Han , Micheline Kamber and Jian Pei , *"Data Mining - Concepts and Techniques"* , Third Edition, Morgan Kaufmann, 2012, ISBN 978-0-12-381479-1
2	Dunham, Margaret H , *"Data Mining: Introductory and Advanced Topics"*, 1st Edition , PHI/Pearson, 2006 , ISBN 978-81-7758-785-2
References	
1	Sumathi, S., Sivanandam, S.N. , *"Introduction to Data Mining and its Applications"*, Springer , 2006 , ISBN 978-3-540-34351-6
2	P. Tan, M. Steinbach and V. Kumar, *"Introduction to Data Mining"*, 2nd Edition, Addison Wesley, 2019,
3	Related papers from various IEEE Transactions , Int. Journals / Conferences.
Useful Links	
1	Data sets : https://archive.ics.uci.edu/ml/index.php
2	IEEE Transactions on Knowledge and Data Engineering : https://ieeexplore.ieee.org/xpl/RecentIssue.jsp?punumber=69
3	Tools - Tableau : https://www.tableau.com/developer/tools , SPSS : https://www.ibm.com/in-en/analytics/spss-statistics-software , Weka : https://www.cs.waikato.ac.nz/ml/weka/
4	Data Mining Resources : https://www.cs.purdue.edu/homes/ayg/CS590D/resources.html

CO-PO Mapping

	Programme Outcomes (PO)												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2												2	
CO2		3												2
CO3				3									3	
CO4			3											3

The strength of mapping is to be written as 1: Low, 2: Medium, 3: High
Each CO of the course must map to at least one PO.

Assessment

The assessment is based on MSE, ISE and ESE.
MSE shall be typically on modules 1 to 3.
ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO.
ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6.
For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

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Course Information	
Programme	B.Tech. (Computer Science & Engineering)
Class, Semester	Final Year B. Tech., Sem VII
Course Code	5CS413
Course Name	Elective 6: Software Defined Network
Desired Requisites:	Computer Network and Data Communication

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	3 Hrs/week	**MSE**	**ISE**	**ESE**	**Total**
Tutorial	-	30	20	50	100
		Credits: 3			

Course Objectives	
1	To understand SDN/NFV motivation and benefits.
2	To describe how SDN/Openflow work.
3	To understand mininet and some programming languages.

Course Outcomes (CO) with Bloom's Taxonomy Level

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

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Description**
CO1	understand OpenFlow, challenges in SDN, and the recent development in SDN	II	Understanding
CO2	Analyse and apply implementation of SDN through Open Flow Switches, SDN-Controllers.	IV, III	Analysing, Applying
CO3	Evaluate the pros and cons of applying SDN, API approaches, Hypervisor overlays, and SDN Data Centre	V	Evaluating

Module	**Module Contents**	**Hours**
I	**History and Evolution of Software Defined Networking (SDN)** 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

Textbooks	
1	SDN: Software Defined Networks, an Authoritative Review of Network Programmability Technologies, By Thomas D. Nadeau, Ken Gray Publisher: O'Reilly Media, August 2013, ISBN: 978-1-4493-4230-2, ISBN 10:1-4493-4230-2.
2	Software Defined Networks: A Comprehensive Approach, by Paul Goransson and Chuck Black, Morgan Kaufmann, June 2014, Print Book ISBN: 9780124166752, eBook ISBN : 9780124166844
References	
1	SDN and OpenFlow for Beginners by Vivek Tiwari, Sold by: Amazon Digital Services, Inc., ASIN: , 2013.
2	Network Innovation through OpenFlow and SDN: Principles and Design, Edited by Fei Hu, CRC Press, ISBN-10: 1466572094, 2014
3	sdnhub.org
Useful Links	
1	https://www.youtube.com/watch?v=dkUDUb9GtH0&list=PLpherdrLyny8YN4M24iRJBMCXkLcGbmhY&ab_channel=NickFeamster

CO-PO Mapping														
	Programme Outcomes (PO)												**PSO**	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1		2			3							1		
CO2					3							2		
CO3												2		

The strength of mapping is to be written as 1: Low, 2: Medium, 3: High
Each CO of the course must map to at least one PO.

Assessment

The assessment is based on MSE, ISE and ESE.
MSE shall be typically on modules 1 to 3.
ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO.
ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6.
For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

Walchand College of Engineering, Sangli

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Course Information	
Programme	B.Tech. (Computer Science and Engineering)
Class, Semester	Final Year B. Tech., Sem VII
Course Code	5CS414
Course Name	Elective- 6: Computer Vision
Desired Requisites:	Digital Image Processing

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	3 Hrs/week	**MSE**	**ISE**	**ESE**	**Total**
Tutorial	-	30	20	50	100
		Credits: 3			

Course Objectives	
1	To impart knowledge of advanced techniques in computer vision.
2	To acquaint students with the concepts of color image processing, texture analysis, object recognition, video processing, 3D imaging etc. by applying the algorithms to build applications.
3	To allow students to compare various algorithms and select the one most appropriate for a particular application.

Course Outcomes (CO) with Bloom's Taxonomy Level

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

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Description**
CO1	Demonstrate the knowledge of the various concepts of computer vision.	III	Applying
CO2	Apply and Analyse different computer vision algorithms to solve real life problems	IV	Analyze
CO3	Illustrate and critique different techniques employed in computer vision	V	Evaluate

Module	**Module Contents**	**Hours**
I	**Color Image Processing** Color Fundamentals, Color models, Gray level to color transformations, Basics of Color Image Processing, Color Transformations, Smoothing and Sharpening, Color Segmentation	6
II	**Texture Analysis** Definition, Types of texture, Texels, Texture analysis – concept and categories, Approaches to texture analysis, Statistics, Texture descriptors - statistical - Auto-correlation, co-occurrence matrices and features, edge density and direction, local binary partition, Law's texture energy measures, Wavelets and texture analysis.	7
III	**Representation & Description** Representation, Boundary Descriptors, Regional Descriptors, Use of Principal components for description, Relational Descriptors	6
IV	**Object Recognition & Restoration** **Object Recognition:** Object Detection Vs recognition, Patterns and Pattern Classes, Knowledge Representation, Statistical Pattern Recognition, Neural Nets, Syntactic Pattern Recognition,Optimization Techniques in Recognition. **Restoration:** Image Restoration Model, Noise Models,Restoration using spatial filtering, Reduction using frequency domain filtering.	8

V	**Moving Object Detection and Tracking** Introduction, Background Modeling, Connected Component Labeling, Shadow Detection, Single Object Tracking, Discrete Kalman Filtering, Particle-filter based tracking, Mean-shift tracking, Segmentation tracking via graph cuts	6
VI	**3D Vision** Introduction to 3D imaging ,applications. Case study based on the current trends in 3D imaging	6

Textbooks	
1	R. C. Gonzalez, R. E. Woods, Digital Image Processing, 4th Edition. 2018, PHI
2	A. K. Jain, Fundamentals of Digital Image Processing, PHI
References	
1	Milan Sonka, Vaclav Hlavac, Boyle, Digital Image Processing and Computer Vision, Cengage Learning
2	S. Jayaraman, S. Esakkirajan, T. Veerkumar, Digital Image Processing, Tata McGrawHill
3	Rafael C. Gonzalez, Richard E. Woods, Steven L. Eddins, Digital Image Processing Using MATLAB, 2nd ed.
Useful Links	
1	NPTEL course: Link
2	NPTEL course: Link

CO-PO Mapping

	Programme Outcomes (PO)												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2													
CO2	3		2											
CO3			2	3										

The strength of mapping is to be written as 1: Low, 2: Medium, 3: High
Each CO of the course must map to at least one PO.

Assessment

The assessment is based on MSE, ISE and ESE.
MSE shall be typically on modules 1 to 3.
ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO.
ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6.
For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

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Course Information

Programme	B.Tech. (Computer Science and Engineering)
Class, Semester	Final Year B. Tech., Sem VII
Course Code	5CS415
Course Name	Elective-6: MOOC on AI ML: Reinforcement Learning
Desired Requisites:	B.Tech. (Computer Science and Engineering)

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	3 Hrs/week	**MSE**	**ISE**	**ESE**	**Total**
Tutorial	-	30	20	50	100
		Credits: 3			

Course Objectives

1	To illustrate and apply the algorithm Reinforcement techniques.
2	To explain and demonstrate different reinforcement techniques for real world problem
3	To analyse reinforcement algorithm while applying to computation problem

Course Outcomes (CO) with Bloom's Taxonomy Level

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

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Description**
CO1	Discuss the fundamentals of Reinforcement Learning.	II	Understanding
CO2	Apply knowledge of formulation of reinforcement techniques to solve real word solution	III	Applying
CO3	Critically analyze the various reinforcement techniques for a given problem.	IV	Analyzing

Module	**Module Contents**	**Hours**
I	Introduction, Bandit algorithms – UCB, PAC	6
II	Bandit algorithms –Median Elimination, Policy Gradient Full RL & MDPs	7
III	Bellman Optimalit, Dynamic Programming & TD Methods	6
IV	Eligibility Traces, Function Approximation	7
V	Least Squares Methods,Fitted Q, DQN & Policy Gradient for Full RL	6
VI	Hierarchical RL, POMDPs	7

Textbooks

1	R. S. Sutton and A. G. Barto. Reinforcement Learning - An Introduction. MIT Press. 1998.

References

1	R. S. Sutton and A. G. Barto. Reinforcement Learning - An Introduction. MIT Press. 1998.

Useful Links

1	https://onlinecourses.nptel.ac.in/noc22_cs34/preview

CO-PO Mapping

	Programme Outcomes (PO)												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2	--	--	--	--	--	--	--	--	--	--	--	--	--
CO2	3	1	--	--	--	--	--	--	--	--	--	--	--	--
CO3	--	3	--	2	--	--	--	--	--	--	--	--	--	--
CO4	--	--	--	2	--	--	--	--	--	--	--	--	--	--
CO5	--	--	3	--	--	--	--	--	--	--	--	--	--	--
The strength of mapping is to be written as 1: Low, 2: Medium, 3: High Each CO of the course must map to at least one PO.														

Assessment
The assessment is based on MSE, ISE and ESE. MSE shall be typically on modules 1 to 3. ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO. ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6. For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

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Course Information	
Programme	B.Tech. (Computer Science and engineering)
Class, Semester	Final Year B. Tech., Sem VII
Course Code	5CS451
Course Name	Elective 5 Lab-High Performance Computing Lab
Desired Requisites:	Data structures, Basic Programming knowledge

Teaching Scheme		**Examination Scheme (Marks)**			
Practical	2 Hrs/ week	**LA1**	**LA2**	**Lab ESE**	**Total**
Interaction	-	30	30	40	100
		Credits: 1			

Course Objectives	
1	To provide basics of parallel architectures
2	To provide basics of parallel algorithm design and analysis
3	To provide basics of parallel programming platforms
4	

Course Outcomes (CO) with Bloom's Taxonomy Level

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

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Description**
CO1	Comparison of different parallel architectures and performance evaluation	I	Understand
CO2	To measure performance of model using different metrics	II	Apply
CO3	To design a parallelization strategy for computing patterns on different hardware and using different parallel computing languages.	VI	Create

List of Experiments / Lab Activities/Topics

List of Topics(Applicable for Interaction mode):

List of Lab Activities:

A. Implementation of following tasks using OpenMP.

1. Implementation of sum of two lower triangular matrices.
2. Implementation of Matrix-Matrix Multiplication.
3. Implementation of dot product
4. Implementation of Prefix sum

B. Implementation of following tasks using MPI.

5. Implementation of Matrix-Vector Multiplication.
6. Implementation of Matrix-Matrix Multiplication.
7. Implementation of 2D Convolution
8. Implementation of dot product
9. Implementation of Prefix sum

C. Implementation of following tasks using CUDA.

10. Implementation of Matrix-matrix Multiplication using global memory.
11. Implementation of Matrix-Matrix Multiplication using shared memory.
12. Implementation of Histogram
13. Implementation of Odd even sort
14. Implementation of Prefix sum
15. Implement 2D Convolution using shared memory

D. Performance evaluation of following computations using open source libraries or OpenACC compare to sequential and explicit parallel implementation

16. Implementation of Matrix-Matrix multiplication using OpenACC MKL, and cuBLAS. Compare their performance with OpenMP based implementation from assignment no.2, 10 and 11.

Textbooks	
1	Zbigniew J. Czech, Introduction to Parallel Computing, Cambridge University Press, 2016.
2	Kumar, V., Grama, A., Gupta, A., & Karypis, G. (1994). Introduction to parallel computing (Vol. 110). Redwood City, CA: Benjamin/Cummings.
3	Chandra, R., Dagum, L., Kohr, D., Menon, R., Maydan, D., & McDonald, J. (2001). Parallel programming in OpenMP. Morgan kaufmann.
4	Cheng, J., Grossman, M., & McKercher, T. (2014). Professional CUDA c programming. John Wiley & Sons.

References	
1	Michael Quinn, Parallel Computing: Theory and Practice, McGrawHill Publishers, July 2017.
2	Arch Robison, James Reinders, and Michael Macoul, Structured Parallel Programming: Patterns for Efficient Computation, Morgan Kaufman, Elsevier, 2012.

Useful Links	
1	

CO-PO Mapping

	Programme Outcomes (PO)												**PSO**	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1				1	1								1	1
CO2				2	2								2	1
CO3				2	2								2	1

The strength of mapping is to be written as 1,2,3; where, 1: Low, 2: Medium, 3: High
Each CO of the course must map to at least one PO, and preferably to only one PO.

Assessment				
There are three components of lab assessment, LA1, LA2 and Lab ESE. IMP: Lab ESE is a separate head of passing.(min 40 %), LA1+LA2 should be min 40%				
Assessment	**Based on**	**Conducted by**	**Typical Schedule**	**Marks**
LA1	Lab activities, attendance, journal	Lab Course Faculty	During Week 1 to Week 8 Marks Submission at the end of Week 8	30
LA2	Lab activities, attendance, journal	Lab Course Faculty	During Week 9 to Week 16 Marks Submission at the end of Week 16	30
Lab ESE	Lab activities, journal/ performance	Lab Course Faculty and External Examiner as applicable	During Week 18 to Week 19 Marks Submission at the end of Week 19	40
Week 1 indicates starting week of a semester. Lab activities/Lab performance shall include performing experiments, mini-project, presentations, drawings, programming, and other suitable activities, as per the nature and requirement of the lab course. The experimental lab shall have typically 8-10 experiments and related activities if any.				

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Course Information

Programme	B.Tech. (Computer Science and Engineering)
Class, Semester	Final Year B. Tech., SemVII
Course Code	5CS452
Course Name	Elective 5 lab- Data Mining Lab
Desired Requisites:	Database Engineering

Teaching Scheme		**Examination Scheme (Marks)**			
Practical	2 Hrs/ Week	**LA1**	**LA2**	**Lab ESE**	**Total**
Interaction		30	30	40	100
		Credits: 1			

Course Objectives

1	The hands-on and practically implementation of the concepts/techniques studied in theory course.
2	Exposure to real life data sets for analysis and prediction.
3	Learning performance evaluation of data mining algorithms in a supervised and an unsupervised mode with different data mining tools.
4	Handling a mini data mining project for a given practical domain.

Course Outcomes (CO) with Bloom's Taxonomy Level

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

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Description**
CO1	Interpret the data mining process and handle important issues around data cleaning, pre-processing and integration.	III	Apply
CO2	Analyse the real world problems using different data mining algorithms.	IV	Analyze
CO3	Measure the performance of different data mining algorithms / tools.	V	Evaluate
CO4	Design and build the data mining system for solving any complex problem.	VI	Create

List of Experiments / Lab Activities/Topic

List of Lab Activities:

1. For iris and breast cancer data set
   a) Calculate the mean, median, and standard deviation of conditional attributes.
   b) Draw histogram
   c) Draw the boxplots for pairs of attributes.
   d) Draw a scatter plot and a Quantile-Quantile (q-q) plot based on these two variables.

2. For iris and breast cancer data set, perform the
   a) Correlation analysis
   b) discretization using Binning and Histogram Analysis

3. Design and implementation of following classifiers :
   a. Regression classifier.
   b. Naïve Bayesian Classifier.
   c. k-NN classifier (Take k = 1,3,5,7)
   d. Three layer Artificial Neural Network (ANN) classifier (use back propagation)

4. Design and implementation of following clustering algorithms :
   a) Hierarchical clustering - AGNES & DIANA. Plot Dendrogram.
   b) k-Means
   c) k-Medoids (PAM)
   d) DBSCAN

5. Design and implementation of following Association Rule Mining algorithms :
   a) Basic Association Rule Mining Algorithm
   b) Apriori Algorithm

6. Design and implementation of following Web Mining algorithms :
   a) Implement the PageRank algorithm to calculate the rank of each page in the file. The outputshould be the 10 pages with the highest rank, together with their rank values.
   b) Implement the HITS algorithm to calculate the hub and the authority weight of each web page inthe data set. The output should be the 10 most authoritative pages and 10 most hubby pages.

7. Hands on with the state of the art data analytics tools like Tableau , Weka , SPSS, Oracle DataMiner etc.

8. Mini-project : Group (2/3) of students should search any research journal / literature on data miningand select small problem statement. Design and build the data mining system for chosen problem. OR instructor may assign any problem statement for each group.

Instructions :

1. Use the standard data sets from UCI Machine Learning Repository
2. Follow the design, modelling and implementation/documentation methodology using standard CASEtools.
3. Use Python as Programming Language. For database programming / scripting use PL/SQL T-SQL,MySQL/Oracle 11g /IBM DB2 9.7 as backend database server. Follow the submission guidelines.

Textbooks	
1	Jiawei Han , Micheline Kamber and Jian Pei , “Data Mining - Concepts and Techniques” , Third Edition, Morgan Kaufmann, 2012, ISBN 978-0-12-381479-1
2	Dunham, Margaret H , “Data Mining: Introductory and Advanced Topics”, 1st Edition , PHI/Pearson, 2006 , ISBN 978-81-7758-785-2
3	
4	
References	

1	Sumathi, S., Sivanandam, S.N. , “Introduction to Data Mining and its Applications”, Springer , 2006 , ISBN 978-3-540-34351-6
2	P. Tan, M. Steinbach and V. Kumar, "Introduction to Data Mining", 2nd Edition, Addison Wesley, 2019,
3	Related papers from various IEEE Transactions , Int. Journals / Conferences.
4	Open source tools for data analytics and machine learning.
Useful Links	
1	Data sets : https://archive.ics.uci.edu/ml/index.php
2	Tableau tool : https://www.tableau.com/developer/tools
3	SPSS tool : https://www.ibm.com/in-en/analytics/spss-statistics-software
4	Weka tool : https://www.cs.waikato.ac.nz/ml/weka/

CO-PO Mapping

	Programme Outcomes (PO)												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3												1	
CO2		3												2
CO3					2								3	
CO4			3											3

The strength of mapping is to be written as 1,2,3; where, 1: Low, 2: Medium, 3: High
Each CO of the course must map to at least one PO, and preferably to only one PO.

Assessment

There are three components of lab assessment, LA1, LA2 and Lab ESE.
IMP: Lab ESE is a separate head of passing.(min 40 %), LA1+LA2 should be min 40%

Assessment	Based on	Conducted by	Typical Schedule	Marks
LA1	Lab activities, attendance, journal	Lab Course Faculty	During Week 1 to Week 8 Marks Submission at the end of Week 8	30
LA2	Lab activities, attendance, journal	Lab Course Faculty	During Week 9 to Week 16 Marks Submission at the end of Week 16	30
Lab ESE	Lab activities, journal/ performance	Lab Course Faculty and External Examiner as applicable	During Week 18 to Week 19 Marks Submission at the end of Week 19	40

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

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Course Information	
Programme	B. Tech. (Computer Science and Engineering)
Class, Semester	Final Year B. Tech., Sem VII
Course Code	5OE471
Course Name	Open Elective 5: Cyber Security
Desired Requisites:	

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	3 Hrs/week	**MSE**	**ISE**	**ESE**	**Total**
Tutorial	-	30	20	50	100
		Credits: 3			

Course Objectives	
1	Exhibit knowledge to secure corrupted systems, protect personal data, and secure computer networks in an Organization
2	Develop cyber security strategies and policies
3	Understand principles of web security and to guarantee a secure network by monitoring and analyzing the nature of attacks through cyber/computer forensics software/tools.

Course Outcomes (CO) with Bloom's Taxonomy Level

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

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

Module	**Module Contents**	**Hours**
I	**Introduction to Cyber Space** 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

Textbooks	
1	Nina Godbole and Sunit Belpure, "*Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives"*, Wiley
2	B. B. Gupta, D. P. Agrawal, Haoxiang Wang, *"Computer and Cyber Security: Principles, Algorithm, Applications, and Perspectives"*, CRC Press, ISBN 9780815371335, 2018

References	
1	"*Cyber Security Essentials*", James Graham, Richard Howard and Ryan Otson, CRC Press

Useful Links	
1	https://onlinecourses.swayam2.ac.in/ugc19_hs25/preview m2.ac.in
2	https://www.classcentral.com/course/swayam-introduction-to-cyber-security-14116
3	https://www.youtube.com/watch?v=AU3sdN-ZPCQ

CO-PO Mapping

	Programme Outcomes (PO)												**PSO**	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	3											2	
CO2		3			2								3	
CO3	3	3											3	3
CO4		2	3										3	1
CO5				3									2	

The strength of mapping is to be written as 1: Low, 2: Medium, 3: High
Each CO of the course must map to at least one PO.

Assessment

The assessment is based on MSE, ISE and ESE.
MSE shall be typically on modules 1 to 3.
ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO.
ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6.
For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

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AY 2022-23

Course Information	
Programme	B.Tech. (Computer Science and Engineering)
Class, Semester	Final Year B. Tech., Sem VIII
Course Code	5CS421
Course Name	Industry Course : Data Management, Protection and Governance (By Veritas)
Desired Requisites:	

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	3 Hrs/week	**MSE**	**ISE**	**ESE**	**Total**
Tutorial	-	30	20	50	100
		Credits: 3			

Course Objectives	
1	Get acquainted with the high-level phases of data life cycle management.
2	Acquire knowledge about the various aspects of data storage, data availability, data protection.
3	Gain exposure to various solutions/reference architectures for various use-cases.
4	Understand the technical capabilities and business benefits of data protection.

Course Outcomes (CO) with Bloom's Taxonomy Level

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

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Description**
CO1	Illustrate data management world and various types of data threats and approaches to ensure data center security.	II	Understand
CO2	Apply different standards for compliance and governance of data.	III	Apply
CO3	Analyze various types of data threats and approaches to ensure data centre security.	IV	Analyze
CO4	Discriminate various concepts and technologies for enabling data storage and high availability	V	Evaluate
CO5	Design data intensive enterprise applications and industry standard solutions in data management.	VI	Create

Module	**Module Contents**	**Hours**
I	**Introduction to data life cycle management (DLM)** 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, thin provisioning, Cloud storage – S3, glacier, storage tiering, High Availability-Introduction to high availability, clustering, failover, parallel access, Disaster Recovery -Need of disaster recovery, Building blocks - global cluster, wide-area-connector (WAC), heartbeat, Split-brain – problem and solutions , Preparing for DR – firedrill.	8

III	**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
IV	**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
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

Textbooks	
1	Robert Spalding, "*Storage Networks: The complete Reference*" Tata McGraw-Hill
2	Vic (J.R.) Winkler, "Securing The Cloud: Cloud Computing Security Techniques and Tactics" (Syngress/Elsevier) - 978-1-59749-592-9.
3	TBD – online reference for each topic.

References	
1	"Designing Data-Intensive Applications " (O'Reilly, Martin Kleppmann).
2	TBD: provide more online material details and books (This can include some publicly available white-paper, solution guides etc.)

Useful Links	
1	https://www.enterprisestorageforum.com/storage-hardware/storage-virtualization.html
2	https://www.hitechnectar.com/blogs/three-goals-data-lifecycle-management/
3	https://www.bmc.com/blogs/data-lifecycle-management/
4	https://www.dataworks.ie/5-stages-in-the-data-management-lifecycle-process/

CO-PO Mapping

	Programme Outcomes (PO)												**PSO**	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1		3											2	
CO2	3												3	
CO3	3	2												3
CO4		3												1
CO5		3												

The strength of mapping is to be written as 1: Low, 2: Medium, 3: High
Each CO of the course must map to at least one PO.

Assessment
The assessment is based on MSE, ISE and ESE. MSE shall be typically on modules 1 to 3. ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO. ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6. For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

Walchand College of Engineering, Sangli

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Course Information

Programme	B.Tech. (Computer Science and engineering)
Class, Semester	Final Year B. Tech., Sem VIII
Course Code	5CS492
Course Name	Project-II
Desired Requisites:	Nil

Teaching Scheme		**Examination Scheme (Marks)**			
Practical	12 Hrs/ week	**LA1**	**LA2**	**Lab ESE**	**Total**
Interaction	-	30	30	40	100
		Credits: 6			

Course Objectives

1	To experience project management principles to become IT industry savvy.
2	To utilize state of the art CASE tools especially for design, development and testing phases.
3	To acquaint the ability to map technical skills to real life applications from customers perspective.
4	To practice of specifying & using artifacts as per quality standards.

Course Outcomes (CO) with Bloom's Taxonomy Level

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

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Description**
CO1	demonstrate the state-of-art technological trends through planning and design project aspects.	III	Apply
CO2	adopt agile methodology and mature team skills through various SDLC phases.	V	Evaluate
CO3	showcase the project with real life use case mainly to potential customers.	VI	Create
CO4	analyse performance of developed product and write/publish technical artifacts	IV	Analyse

List of Experiments / Lab Activities/Topics

List of Topics(Applicable for Interaction mode):

List of Lab Activities:

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

Textbooks

1	Nil

References

1	Nil

Useful Links	
1	

CO-PO Mapping														
	Programme Outcomes (PO)												**PSO**	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	--	--	--	--	--	--	--	3	2	--	--	--	--	--
CO2	--	--	--	--	3	--	--	--	2	3	--	--	--	--
CO3	--	--	2	3	--	--	--	--	--	--	2	--	--	--
CO4	--	--	--	--	2	--	--	--	2	--	--	--	--	--
The strength of mapping is to be written as 1,2,3; where, 1: Low, 2: Medium, 3: High Each CO of the course must map to at least one PO, and preferably to only one PO.														

Assessment				
There are three components of lab assessment, LA1, LA2 and Lab ESE. IMP: Lab ESE is a separate head of passing.(min 40 %), LA1+LA2 should be min 40%				
Assessment	**Based on**	**Conducted by**	**Typical Schedule**	**Marks**
LA1	Lab activities, attendance, journal	Lab Course Faculty	During Week 1 to Week 8 Marks Submission at the end of Week 8	30
LA2	Lab activities, attendance, journal	Lab Course Faculty	During Week 9 to Week 16 Marks Submission at the end of Week 16	30
Lab ESE	Lab activities, journal/ performance	Lab Course Faculty and External Examiner as applicable	During Week 18 to Week 19 Marks Submission at the end of Week 19	40
Week 1 indicates starting week of a semester. Lab activities/Lab performance shall include performing experiments, mini-project, presentations, drawings, programming, and other suitable activities, as per the nature and requirement of the lab course. The experimental lab shall have typically 8-10 experiments and related activities if any.				

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Course Information	
Programme	B.Tech. (Computer Science and Engineering)
Class, Semester	Final Year B. Tech., Sem VIII
Course Code	5CS431
Course Name	Elective-7:Search Engine Design and Optimization
Desired Requisites:	Programming Laboratory – 3

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	3 Hrs/week	**MSE**	**ISE**	**ESE**	**Total**
Tutorial	-	30	20	50	100
		Credits: 3			

Course Objectives	
1	To inculcate understanding of detailed functions of search engines and different SEO techniques.
2	To illustrate working of different search engine designs and different SEO techniques.
3	To emphasize on optimizing design of search engines and use of SEO techniques.

Course Outcomes (CO) with Bloom's Taxonomy Level

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

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Description**
CO1	describe working of search engines and SEO techniques	II	Understand
CO2	illustrate various SEO techniques and use SEO tools	III	Apply
CO3	comprehend strengths and weaknesses of SEO techniques and use appropriate SEO technique as per real life scenario and analyze the performance of a website on a search engine using tools and analytical data	IV	Analyze

Module	**Module Contents**	**Hours**
I	**Search Engines and SEO Overview** 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

Textbooks	
1	Jessie Stricchiola, Stephan Spencer, Eric Enge, "The Art of SEO - Mastering Search Engine Optimization".
2	Moz, "Beginner's Guide to SEO".

References	
1	Adam Clarke, "SEO 2021: Learn search engine optimization with smart internet marketing"

Useful Links	
1	https://analytics.google.com/analytics/academy/course/6

CO-PO Mapping

	Programme Outcomes (PO)												**PSO**	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1		1											1	
CO2	2	2	3										2	
CO3		3	2		3								2	1

The strength of mapping is to be written as 1: Low, 2: Medium, 3: High
Each CO of the course must map to at least one PO.

Assessment

The assessment is based on MSE, ISE and ESE.
MSE shall be typically on modules 1 to 3.
ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO.
ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6.
For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

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AY 2022-23

Course Information	
Programme	B.Tech. (Computer Science and Engineering)
Class, Semester	Final Year B. Tech., Sem VIII
Course Code	5CS432
Course Name	Elective-7: Computer Forensic
Desired Requisites:	Cyber Security

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	3 Hrs/week	**MSE**	**ISE**	**ESE**	**Total**
Tutorial	-	30	20	50	100
		Credits: 3			

Course Objectives	
1	To understand the basic digital forensics and techniques for conducting the forensic examination on different digital devices.
2	To understand how to examine digital evidence such as data acquisition, identification analysis.
3	To understand cyber related crimes and various investigative strategies
4	To understand various data storage methods, formats and computer forensic tools

Course Outcomes (CO) with Bloom's Taxonomy Level

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

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Description**
CO1	Apply the methods for data recovery, evidence collection and data seizure.	III	Applying
CO2	Analyze a large amount of digital evidence and identify the most significant data.	IV	Analysing
CO3	Evaluate the different types of computer forensics technologies	V	Evaluating
CO4	Apply a number of different computer forensic tools to a given scenario.	III	Applying

Module	**Module Contents**	**Hours**
I	**Introduction** 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, Cloud storage and forensics.	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

Textbooks	
1	Warren G. Kruse II and Jay G. Heiser, "Computer Forensics: Incident Response Essentials", Addison Wesley
2	B Nelson, B, Phillips, A, Enfinger, F, Stuart, C., "Guide to Computer Forensics and Investigations", 2nd ed., Thomson Course Technology
3	
4	

References	
1	Vacca, J, "Computer Forensics, Computer Crime Scene Investigation", 2nd Ed, Charles River Media, ISBN: 1-58450-38
2	
3	
4	

Useful Links	
1	
2	
3	
4	

CO-PO Mapping

	Programme Outcomes (PO)												**PSO**	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	3	2										2	
CO2	1	1	2										3	
CO3	3	3											2	3
CO4	3	2			3								2	1

The strength of mapping is to be written as 1: Low, 2: Medium, 3: High
Each CO of the course must map to at least one PO.

Assessment

The assessment is based on MSE, ISE and ESE.
MSE shall be typically on modules 1 to 3.
ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO.
ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6.
For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

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AY 2022-23

Course Information

Programme	B.Tech. (Computer Science and Engineering)
Class, Semester	Final Year B. Tech., Sem VIII
Course Code	5CS433
Course Name	Elective-8: Human Computer Interaction
Desired Requisites:	Nil

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	3 Hrs/week	**MSE**	**ISE**	**ESE**	**Total**
Tutorial	-	30	20	50	100
		Credits: 3			

Course Objectives

1	To inculcate understanding of detailed functions of HCI and different HCI techniques.
2	To illustrate working of different HCI designs and different HCI techniques.
3	To emphasize on HCI evaluation and Implementation techniques.

Course Outcomes (CO) with Bloom's Taxonomy Level

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

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Description**
CO1	Describe working of HCI and HCI basics.	II	Understand
CO2	Illustrate various HCI design principals.	III	Apply
CO3	Comprehend strengths and weaknesses of HCI design techniques and use appropriate HCI technique as per real life.	IV	Analyze

Module	**Module Contents**	**Hours**
I	**Foundations of Human–Computer Interaction** What is HCI – design, models, evaluation, Need to understand people, computers and methods. Basic human abilities - vision, hearing, touch, memory. Computers – speed, interfaces, widgets, and effects on interaction. Humans – Memory, Attention Span, Visual Perception, psychology, ergonomics. Understanding Users. Methods for evaluation of interfaces with users: goals of evaluation, approaches, ethics, introspection, extracting the conceptual model, direct observation, constructive interaction, interviews and questionnaires, continuous evaluation via user feedback and field studies, choosing an evaluation method.	07
II	**The Design Process** Interaction Design Basics, Interaction Styles. HCI in the Software Process. HCI design principles and rules: design principles, principles to support usability, golden rules and heuristics, HCI patterns, design rules, HCI design standards. Universal Design, User-centered design, task analysis/GOMS, Graphic Design, Real life scenario study in design process.	06
III	**Implementation** Implementation Tools, Technology and change designing for the Web, designing for portable devices. Handling errors and Designing Help. Prototyping and UI Software. Real life scenario study in implementation process.	07

IV	**Evaluation and User Support** Evaluation of User Interfaces. Web Browsers - Fonts, Color Palette, Color Depth, Resolution, Layout, Size, Orientation. Mobile devices issues – design, limitations, what next. User Support, Real life scenario study in implementation process.	07
V	**Users Models** Predictive Models, Cognitive Models. Interaction with Natural Languages, Next Generation Interface. Socio-organizational Issues and Stakeholder Requirements. Heuristic Evaluation, Evaluation with Cognitive Models, Evaluation with Users, Real life scenario study in implementation process.	06
VI	**Case Study of Modern Systems** Group ware, Virtual Reality, Augmented Reality, Hypertext, Multimedia and World Wide web, GUI design for a mobile phone based Matrimonial application during emergency.	06

Textbooks	
1	Alan J, Dix. Janet Finlay, Rusell Beale, "Human Computer Interaction", Pearson Education, 3rd Edition, 2004, ISBN 81-297-0409-9
2	Jenny Preece, Rogers, Sharp, “Interaction Design-beyond human-computer interaction”, WILEY-INDIA, ISBN 81-265-0393-9

References	
1	Jonathan Lazar, Jinjuan Feng, Harry Hochheiser, “Research Methods in Human-Computer Interaction", Third Edition, Morgan Kaufmann, 2017, ISBN: 9780128053904.
2	Mary Beth Rosson and John M. Carroll, “Usability Engineering: Scenario-Based Development of Human-Computer Interaction”, Morgan Kaufmann, 2001, ISBN-13: 978- 1558607125

Useful Links	
1	https://nptel.ac.in/courses/106/103/106103115/
2	https://www.coursera.org/learn/human-computer-interaction

CO-PO Mapping

	Programme Outcomes (PO)												**PSO**	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1		1											1	
CO2	2	2	3										2	
CO3		3	2		3								2	1

The strength of mapping is to be written as 1: Low, 2: Medium, 3: High
Each CO of the course must map to at least one PO.

Assessment

The assessment is based on MSE, ISE and ESE.
MSE shall be typically on modules 1 to 3.
ISE shall be taken throughout the semester in the form of teacher’s assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO.
ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6.
For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

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Course Information	
Programme	B.Tech. (Computer Science and Engineering)
Class, Semester	Final Year B. Tech., Sem VIII
Course Code	5CS434
Course Name	Elective-8: MOOC Course on Social Networks
Desired Requisites:	Discrete Mathematics and Linear Algebra, Programming and Algorithms

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	3 Hrs/week	**MSE**	**ISE**	**ESE**	**Total**
Tutorial	-	30	20	50	100
		Credits: 3			

Course Objectives	
1	To provide knowledge of the basics of social networks.
2	To describe various social network algorithms.
3	To demonstrate social network analysis applicable to real world data, with examples from today's most popular social networks
4	To understand real world problems for social network

Course Outcomes (CO) with Bloom's Taxonomy Level

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

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Description**
CO1	Describe basic characteristics of social network and social network analysis	II	Understand
CO2	Illustrate different social network analyzing algorithms and concepts	III, IV	Apply,Analyze
CO3	Evaluate different social networks with the help of real time datasets	V	Evaluate
CO4	Create social network for real world problems	VI	Create

Module	**Module Contents**	**Hours**
I	**Introduction** Introduction to networkx, challenges of social networks, Searching in a network, link prediction, the contagions, Importance of acquaintances, marketing on social networks, handling real world network datasets.	8
II	**Strength of weak ties and homophily** Granovetter's Strength of weak ties, Triads, Clustering coefficient and neighborhood overlap, Structure of weak ties bridges and local bridges, Embedeness, structural holes, Social capital, Finding communities in a graph, Foci closure membership closure.	6
III	**Positive negative relationships and link analysis** Structural balance, Characterising the structure of a balanced network, Balance theorem and its proof, Introduction to positive and negative edges, the web graph, collecting the web graph, equal coin distribution, random coin dropping, Introduction to hubs and authorities.	6
IV	**Cascading Behaviors in networks** Diffusion in networks, modelling diffusion, impact of communities on diffusion, Cascade and clusters.	6

V	**Richer get richer phenomenon** Introduction to powerlaw, detection of powerlaw, forced vs random removal of nodes, richer ger richer phenomenon, epidemics, spreading models, percolation models.	7
VI	**Small world effect** Small world effect, milgram's experiment, Generative model and decentralised search, how to go viral on web.	7

Textbooks	
1	Matthew A. Russell. Mining the Social Web: Data Mining Facebook, Twitter, Linkedin, Google+, Github, and More, 2nd Edition, O'Reilly Media, 2013.
2	Jennifer Golbeck, Analyzing the social web, Morgan Kaufmann, 2013.
References	
1	Charu Aggarwal (ed.), Social Network Data Analytics, Springer, 2011.
Useful Links	
1	https://nptel.ac.in/courses/106106169
2	http://cse.iitkgp.ac.in/~pawang/courses/SC16.html

CO-PO Mapping

	Programme Outcomes (PO)												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1		1											2	
CO2	1												3	
CO3	3	3												3
CO4		2												1

The strength of mapping is to be written as 1: Low, 2: Medium, 3: High
Each CO of the course must map to at least one PO.

Assessment

The assessment is based on MSE, ISE and ESE.
MSE shall be typically on modules 1 to 3.
ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO.
ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6.
For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

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AY 2022-23

Course Information

Programme	B.Tech. (Computer Science and Engineering)
Class, Semester	Final Year B. Tech., Sem VIII
Course Code	5CS435
Course Name	Elective-8: MOOC Course on Virtual Reality
Desired Requisites:	Nil

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	3 Hrs/week	**MSE**	**ISE**	**ESE**	**Total**
Tutorial	-	30	20	50	100
		Credits: 3			

Course Objectives

1	To inculcate understanding of detailed functions of VR and different VR techniques
2	To illustrate working of different VR designs and different VR techniques
3	To emphasize on VR evaluation and Implementation techniques

Course Outcomes (CO) with Bloom's Taxonomy Level

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

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Description**
CO1	Describe working of VR and VR basics.	II	Understand
CO2	Illustrate various VR design principals	III	Apply
CO3	Comprehend strengths and weaknesses of VR design techniques and use appropriate VR technique as per real life	IV	Analyze
CO4			

Module	**Module Contents**	**Hours**
I	**Introduction** Course mechanics, Goals and VR definitions, Historical perspective, Birds-eye view (general), Birds-eye view (general), Birds-eye view (hardware), Birds-eye view (software) 8. Birds-eye view (sensation and perception)	4
II	**Geometry of Virtual Worlds** Geometric modeling, Transforming models, Matrix algebra and 2D rotations, 3D rotations and yaw, pitch, and roll, 3D rotations and yaw, pitch, and roll, contd, Axis-angle representations, Quaternions, Converting and multiplying rotations, Converting and multiplying rotations, contd, Homogeneous transforms, The chain of viewing transforms, Eye transforms, Canonical view transform, Viewport transform	5
III	**Light and Optics** Three interpretations of light, Refraction, Simple lenses, Diopters, Optical system of eyes	5
IV	**Visual Physiology** Photoreceptors, Sufficient resolution for VR, Light intensity, Eye movements	4
V	**Visual Perception** Depth perception, Depth perception, Motion perception, Frame rates and displays, Frame rates and displays	4
VI	**Tracking Systems** Overview, Orientation tracking, Tilt drift correction, Tracking with a camera, Perspective n-point problem, Filtering	4

Textbooks	
1	Doug A. Bowman,Ernst Kruijff, Joseph J. LaViola, and Ivan Poupyrev, 3D User Interfaces, AddisonWesley, 2005
2	K.S. Hale and K. M.Stanney, Handbook on Virtual Environments, 2nd edition, CRC Press, 2015
References	
1	George Mather, Foundations of Sensation and Perception:Psychology Press; 2 edition, 2009
2	Peter Shirley, MichaelAshikhmin, and Steve Marschner, Fundamentals of Computer Graphics,A K Peters/CRC Press; 3 edition, 2009
Useful Links	
1	http://msl.cs.uiuc.edu/vr/
2	http://nptel.iitm.ac.in/

CO-PO Mapping

	Programme Outcomes (PO)												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1		1											1	
CO2	2	2	3										2	
CO3		3	2		3								2	1

The strength of mapping is to be written as 1: Low, 2: Medium, 3: High
Each CO of the course must map to at least one PO.

Assessment

The assessment is based on MSE, ISE and ESE.
MSE shall be typically on modules 1 to 3.
ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO.
ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6.
For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

Walchand College of Engineering, Sangli

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AY 2022-23

Course Information	
Programme	B.Tech. (Computer Science and Engineering)
Class, Semester	Final Year B. Tech., Sem VIII
Course Code	5CS436
Course Name	Elective-8: MOOC Course on Blockchain and Its applications
Desired Requisites:	Computer Networks; Operating Systems; Cryptography and Network Security.

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	3 Hrs/week	**MSE**	**ISE**	**ESE**	**Total**
Tutorial	-	30	20	50	100
		Credits: 3			

Course Objectives	
1	Inculcate how blockchain systems (mainly Bitcoin and Ethereum) work,
2	Illustrate process of Design, build, and deploy smart contracts and distributed applications,
3	Inculcate how to Integrate ideas from blockchain technology into their own projects.

Course Outcomes (CO) with Bloom's Taxonomy Level

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

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Description**
CO1	Describe basic principles of Blockchain	II	Understand
CO2	Illustrate the different techniques used in Blockchain	III	Apply
CO3	Analyse different Designs, security, privacy, and efficiency of a given blockchain system.	IV	Analyse
CO4			

Module	**Module Contents**	**Hours**
I	Introduction to Blockchain Technology and its Importance	4
II	Basic Crypto Primitives Cryptographic Hash, Digital Signature	7
III	Evolution of the Blockchain Technology, Elements of a Blockchain	8
IV	Blockchain Consensus Permissionless Models, Permissioned Models	7
V	Smart Contract Hands On and Decentralized Identity Management Ethereum Smart Contracts (Permissionless Model), Hyperledger Fabric (Permissioned Model)	8
VI	Blockchain Interoperability and Applications	5

Textbooks	
1	Mastering Blockchain: A deep dive into distributed ledgers, consensus protocols, smart contracts, DApps, cryptocurrencies, Ethereum, and more, 3rd Edition, Imran Bashir, Packt Publishing, 2020, ISBN: 9781839213199, book website: https://www.packtpub.com/product/mastering-blockchain-third-edition/9781839213199

References	
1	NPTEL course on Blockchain and its applications
2	Hyperledger Tutorials - https://www.hyperledger.org/use/tutorials
3	Ethereum Development Resources - https://ethereum.org/en/developers

Useful Links	
1	https://onlinecourses.nptel.ac.in/noc22_cs44/preview

CO-PO Mapping														
	Programme Outcomes (PO)												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2												1	
CO2		1											1	
CO3			2										1	
The strength of mapping is to be written as 1: Low, 2: Medium, 3: High Each CO of the course must map to at least one PO.														

Assessment
The assessment is based on MSE, ISE and ESE. MSE shall be typically on modules 1 to 3. ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO. ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6. For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

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Course Information	
Programme	B.Tech. (Computer Science and Engineering)
Class, Semester	Final Year B. Tech., Sem VIII
Course Code	5CS437
Course Name	Elective 8 : MOOC Course on Computing: Introduction to parallel programming with OpenMP and MPI
Desired Requisites:	Programming in C.

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	3 Hrs/week	**MSE**	**ISE**	**ESE**	**Total**
Tutorial	-	30	20	50	100
		Credits: 3			

Course Objectives	
1	To introduce concepts & programming principles involved in developing scalable parallel applications
2	To apply knowledge of writing scalable programs for multi-core architectures using OpenMP and C.
3	To analyze parallel architecture and discuss the performance metrics of HPC programs.

Course Outcomes (CO) with Bloom's Taxonomy Level

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

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Description**
CO1	To introduce the concepts of high performance computing (HPC) to science and engineering students	II	Understanding
CO2	To apply different parallel computing tools like MPI, OpenMP and CUDA will be used in connection with domain specific problems.	III	Applying
CO3	To apply knowledge of Multi-CPU computing using both distributed and shared memory architecture using OpenMP and MPI based parallelization.	III	Applying
CO4			

Module	**Module Contents**	**Hours**
I	Single Processor Architecture and Basic OpenMP Constructs and Functions, More OpenMP constructs & functions	8
II	Basic Linear Algebra using OpenMP and OpenMP tasks	8
III	Critical Sections, locks and Matrix Factorization using OpenMP	7
IV	Distributed Memory programming and Message Passing Interface (MPI)	6
V	MPI Collectives and Interconnection architectures, Some applications on distributed memory architectures	7
VI	Applications to Graph Algorithms	5

Textbooks	
1	Ananth Grama, Anshul Gupta, George Karypis, Vipin Kumar, "Introduction to Parallel Computing", Addison-Wesely, 2nd Edition, 2003

References	
1	Grama, A., Gupta, A., Karypis, G., and Kumar, V., Introduction to Parallel Computing, Addison Wesley, 2003

2	Gropp, W, Ewing L, and Anthony S. Using MPI: portable parallel programming with the message-passing interface. Vol. 1. MIT press, 1999.
3	Cook, S., CUDA Programming: A Developer's Guide to Parallel Computing with GPUs, M K Publishers, 2012 NVIDIA, CUDA C Programming guide, 2012
Useful Links	
1	https://onlinecourses.nptel.ac.in/noc20_me61/preview
2	OpenMP Tutorial from LLNL (https://computing.llnl.gov/tutorials/openMP

CO-PO Mapping

	Programme Outcomes (PO)												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2												1	1
CO2		3											3	1
CO3		2	2										2	1

The strength of mapping is to be written as 1: Low, 2: Medium, 3: High
Each CO of the course must map to at least one PO.

Assessment

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Course Information	
Programme	B.Tech. (Computer Science and Engineering)
Class, Semester	Final Year B. Tech., Sem VIII
Course Code	5CS438
Course Name	Elective 9 - Advanced Machine Learning
Desired Requisites:	Introduction to Machine Learning

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	3 Hrs/week	**MSE**	**ISE**	**ESE**	**Total**
Tutorial	-	30	20	50	100
		Credits: 3			

Course Objectives	
1	Introduces various mathematical concepts required for machine learning.
2	Understand GAN components, build basic GANs using PyTorch and advanced DCGANs using convolutional layers, control your GAN and build conditional GAN

Course Outcomes (CO) with Bloom's Taxonomy Level

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

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Description**
CO1	Explain advanced mathematical concept required for machine learning	II	Understand
CO2	Understand the intuition behind the fundamental components of Transformers and Recommender system	II	Understand
CO3	Implement case studies on GAN, Transformers and Recommender systems.	III	Apply
CO4	Build conditional GANs capable of generating examples from determined categories	VI	Create

Module	**Module Contents**	**Hours**
I	**Introduction** Backpropagation and automatic differentiation, Machine learning frameworks I: the user interface, Overfitting, Generalization error, Early stopping, Our first hyperparameters: step size/learning rate, minibatch size, Regularization, Application-specific forms of regularization, The condition number, Momentum and acceleration, Momentum for quadratic optimization, Momentum for convex optimization.	8
II	**Intro to GANs and Deep Convolutional GAN** Learn about GANs and their applications, understand the intuition behind the basic components of GANs, and build your very own GAN using PyTorch, Build a more sophisticated GAN using convolutional layers. Learn about useful activation functions, batch normalization, and transposed convolutions to tune your GAN architecture and apply them to build an advanced DCGAN specifically for processing images.	6

III	**Specialized GANs** **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. **Conditional and Controllable GANs:** Understand how to effectively control your GAN, modify the features in a generated image, and build conditional GANs capable of generating examples from determined categories.	8
IV	**Transformers** Motivation, attention models, architecture types, BERT, Roberta, Albert	6
V	**Recommender System** Collaborative filtering, content-based filtering	6
VI	**Case Studies** on GANs, Transformers and Recommender Systems	6

Textbooks	
1	Jacub langr, "GANs in Action: Deep learning with Generative Adversarial Networks" 1st Edition
References	
1	
Useful Links	
1	https://nptel.ac.in/courses/106/106/106106198/
2	https://www.cs.cornell.edu/courses/cs6787/2019fa/
3	https://www.deeplearning.ai/program/generative-adversarial-networks-gans-specialization/

CO-PO Mapping

	Programme Outcomes (PO)												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3													
CO2					3									
CO3			1		2									
CO4			1		2									

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Each CO of the course must map to at least one PO.

Assessment

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Course Information	
Programme	B.Tech. (Computer Science and Engineering)
Class, Semester	Final Year Sem VIII
Course Code	5CS439
Course Name	Elective 9- Big Data Computing
Desired Requisites:	Data Structure & Algorithms, Computer Architecture, Operating System, Database Management Systems

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	3 Hrs/week	**MSE**	**ISE**	**ESE**	**Total**
Tutorial	-	30	20	50	100
		Credits: 3			

Course Objectives	
1	To explain the fundamentals of Big data computing problems, applications and characteristics.
2	To discuss various enabling, storage and streaming ways of Big Data
3	To present Machine learning techniques for Big Data

Course Outcomes (CO) with Bloom's Taxonomy Level

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

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Description**
CO1	Illustrate fundamentals of Big data computing terminology	II	Understanding
CO2	Demonstrate various Big Data enabling techniques	IV	Analyze
CO3	Discuss various Big data storage and streaming platform.	III	Apply

Module	**Module Contents**	**Hours**
I	**Introduction to Big Data** Why Big data computing, where did it come from, big data problems, applications, Characteristics.	5
II	**Introduction to Enabling Technologies for Big Data** Brief introduction of big data enabling techniques Hadoop HDFC, Hadoop YARN MapReduce, Apache Cassandra, HBase, Big Data Streaming Platforms: Apache Spark Streaming, Apache Kafka	7
III	**Hadoop For Big Data** Hadoop distribution file system (HDFS), Goal of Hadoop, read/write process of HDFS, Main configuration tuning parameters to control HDFS performance and robustness, Hadoop 1.0, Hadoop 2.0	7
IV	**Spark** Overview of spark, fundamentals of scala & functional programming, spark concepts. Spark operations, Job execution.	6
V	**Introduction to Big Data Storage Platforms for Large Scale Data Storage** Data placement strategies, CAP theorem, Consistency solution, Design of Zookeeper, Cassandra Query Language. HBase	7
VI	**Big Data Streaming Platforms and Performance engine** Real-time Big data processing with Spark streaming and sliding window analytics, Big data performance engine	8

Textbooks	
1	

References	
1	NPTEL Course Big Data Computing, IIT Patna Dr. Rajiv Misra
Useful Links	
1	*https://nptel.ac.in/courses/106104189*

CO-PO Mapping														
	Programme Outcomes (PO)												**PSO**	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2													
CO2	2	2												
CO3	2	3												
CO4														
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