

MALNAD COLLEGE OF ENGINEERING, HASSAN

(An Autonomous Institution Affiliated to VTU, Belagavi)



Autonomous Programmes

Bachelor of Engineering

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING SYLLABUS

I Semester to VIII Semester
(Complete Syllabus)

Admitted Year 2021-22

VISION

To become a prominent department of Computer Science & Engineering producing competent professionals with research and innovation skills, inculcating moral values and societal concerns.

MISSION

- Impart world class engineering education to produce technically competent engineers.
- Provide facilities and expertise in advanced computer technology to promote research.
- Enhance Industry readiness and entrepreneurial abilities through innovative skills.
- Nurture ethical values and social responsibilities.

PROGRAM EDUCATIONAL OBJECTIVES

- PEO 1 : Graduates will be efficient software developers in diverse fields and will be successful professionals and/or pursue higher studies.
- PEO 2 : Graduates will be capable to adapt to new computing technology for professional excellence and Research and will be lifelong learners.
- PEO 3 : Graduates will work productively exhibiting ethical qualities for the betterment of society.
- PEO 4 : Graduates will possess leadership qualities, work harmoniously in a team with effective communication skills

PROGRAM OUTCOMES

Engineering Graduates will be able to:

1. **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
6. **The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAM SPECIFIC OUTCOMES (PSOs)

Upon graduation, students with a degree B.E. in Computer Science & Engineering will be able to:

PSO – 1: To make the students industry ready by facilitating them with software tools in recent technologies

PSO – 2: To develop IT based solutions for problems in diverse domains

Scheme of Teaching for Academic Year 2021-22

Odd Semester

Physics Cycle

Course Category	Course Code	Course Title	L-T-P	Credits	Contact hours
BS	21PH101	Engineering Physics	4-0-0	4	4
BS	21MA102	Calculus and Numerical Methods	3-2-0	4	5
ES	21EE103	Basic Electrical Engineering	3-0-0	3	3
ES	21MD104A/B	Engineering Drawing	1-0-5	3	6
ES	21CV105	Engineering Mechanics	3-0-0	3	3
BS	21PH106	Engineering Physics Laboratory	0-0-2	1	2
HS	21PE107	Physical Education Activity (PEA)	0-0-2	1	2
PR	21DT108	Design Thinking Laboratory	0-0-2	1	2
		Total		20	27

Chemistry Cycle

Course Category	Course Code	Course Title	L-T-P	Credits	Contact hours
BS	21CH101	Engineering Chemistry	4-0-0	4	4
BS	21MA102	Calculus and Numerical Methods	3-2-0	4	5
ES	21EC103	Basic Electronics Engineering	3-0-0	3	3
ES	21ME104	Elements of Mechanical Engineering	3-0-0	3	3
ES	21CS105	Programming for Problem solving	4-0-0	4	4
BS	21CH106	Engineering Chemistry Laboratory	0-0-2	1	2
ES	21CS107	Computer Programming Laboratory	0-0-2	1	2
PR	21DT108	Design Thinking Laboratory	0-0-2	1	2
		Total		21	25

Even Semester

Chemistry Cycle

Course Category	Course Code	Course Title	L-T-P	Credits	Contact hours
BS	21CH201	Engineering Chemistry	4-0-0	4	4
BS	21MA202	Differential equations and vector calculus	3-2-0	4	5
ES	21EC203	Basic Electronics Engineering	3-0-0	3	3
ES	21ME204	Elements of Mechanical Engineering	3-0-0	3	3
ES	21CS205	Programming for Problem solving	4-0-0	4	4
BS	21CH206	Engineering Chemistry Laboratory	0-0-2	1	2
ES	21CS207	Computer Programming Laboratory	0-0-2	1	2
		Total		20	23

Physics Cycle

Course Category	Course Code	Course Title	L-T-P	Credits	Contact hours
BS	21PH201	Engineering Physics	4-0-0	4	4
BS	21MA202	Differential equations and vector calculus	3-2-0	4	5
ES	21EE203	Basic Electrical Engineering	3-0-0	3	3
ES	21MD204A/B	Engineering Drawing	1-0-5	3	6
ES	21CV205	Engineering Mechanics	3-0-0	3	3
BS	21PH206	Engineering Physics Laboratory	0-0-2	1	2
HS	21PE207	Physical Education Activity (PEA)	0-0-2	1	2
		Total		19	25

Note: BS: Basic Science Course, ES: Engineering Science Course, HS: Humanities Course, PR : Project Based Course, 21MD104/204 A: Manual Drafting, 21MD104/204 B : CAED

B. E. - Computer Science and Engineering
Scheme & Syllabus for II Year
Academic Year 2022-2023
Admission Year 2021-2022

THIRD SEMESTER					
Course Category	Course Code	Course Title	L-T-P	Credits	Contact Hours
BSC	21MA301	Linear Algebra and Integral Transforms	2-1-0	3	4
PCC	21CS302	Computer Organization	3-0-0	3	3
PCC	21CS303	Logic Design	2-0-1	3	4
PCC	21CS304	Data Structures and its Applications	3-0-0	3	3
PCC	21CS305	UNIX and Shell Programming	2-0-1	3	4
PCC	21CS306	Data Structures Laboratory	0-0-1	1	2
AEC	21CS307	Biology for Engineers	0-1-0	1	2
HSMC	21KNS/ 1KNB	Samskrutika Kannada/ Balake Kannada	0-1-0	1	2
BSC	21BCM301	Bridge Course Mathematics -I (Mandate Non-CreditCourse)	3(A)-0-0	AUDIT	3
Total				18	27

Scheme for Academic Year: 2022-2023
Admission Year: 2021-2022

FOURTH SEMESTER					
Course Category	Course Code	Course Title	L-T-P	Credits	Contact Hours
BSC	21MA401	Statistics and Probability	2-1-0	3	4
PCC	21CS402	Finite Automata and Formal Languages	2-1-0	3	4
PCC	21CS403	Object Oriented Programming with JAVA	3-0-1	4	5
PCC	21CS404	Design and Analysis of Algorithms	3-0-0	3	3
PCC	21CS405	Microcontroller and Embedded Systems	2-0-1	3	4
PCC	21CS406	Software Engineering	3-0-0	3	3
PCC	21CS407	Algorithms Laboratory	0-0-1	1	2
UHV	21UHV	Universal Human Values	1-0-0	1	2
PI	21INT1	Summer Internship - I	0-0-1	1	15
BSM	21BCM401	Bridge Course Mathematics - II (Mandate Non-Credit Course)	3(A)-0-0	AUDIT	3
Total				22	45

Scheme & Syllabus for III Year 2021 Admitted Batch

FIFTH SEMESTER					
Course Category	Course Code	Course Title	L-T-P	Credits	Contact Hours
HSMC	21CS501	Technology Management and Entrepreneurship	2-2-0	3	4
PCC	21CS502	Operating Systems	2-2-0	3	4
PCC	21CS503	Data Communications	3-0-0	3	3
PCC	21CS504	Computer Graphics and Visualization	2-0-2	3	4
PCC	21CS505	Database Management Systems	3-0-0	3	3
PCC	21CS506	Database Applications Laboratory	0-0-2	1	2
OEC	21CS507X	Ability Enhancement Course	0-2-0	1	2
PEC	21CS55X	Elective – I	3-0-0	3	3
HSMC	21SCR	Social Connect and Responsibility	0-2-0	1	2
HSMC	21EVS	Environmental Studies (Mandate Non-Credit course)	0-2(A)-0	AUDIT	2
Total				21	29

Sl. No.	Elective – I	
	Course Code	Course Title
1.	21CS551	Artificial Intelligence
2.	21CS552	Data Mining
3.	21CS553	Internet of Things
4.	21CS554	Object Oriented Modeling and Design
5.	21CS555	Advanced Java
6.	21CS556	Operations Research

Sl. No.	Ability Enhancement Course	
	Course Code	Course Title
1	21CS507A	R Programming
2	21CS507B	UI/UX Laboratory
3	21CS507C	Full Stack Development
4	21CS507D	Version Controller with GiT

SIXTH SEMESTER					
Course Category	Course Code	Course Title	L-T-P	Credits	Contact Hours
PCC	21CS601	Machine Learning	3-0-0	3	3
PCC	21CS602	Web Programming	2-0-2	3	4
PCC	21CS603	Computer Networks	3-0-0	3	3
PCC	21CS604	Application Development Laboratory	0-0-2	1	2
PCC	21CS605	Machine Learning Laboratory	0-0-2	1	2
PI	21CS606	Mini Project	0-0-2	2	4
PEC	21CS66X	Elective – II	3-0-0	3	3
OEC	21OE65XX	Open Elective – I	3-0-0	3	3
PI	21INT2	Summer Internship –II	0-0-30	3	30
OEC	21ASK	Analytical Ability and Soft Skills	0-2-0	1	2
SMC	21CIP	Constitution of India and Professional Ethics (Mandate Non-Credit Course)	0-2(A)-0	AUDIT	2
OEC	21SWY	SWAYAM (NPTEL Only)	2-0-0	AUDIT	-
Total				23	58
21CS606 - Mini Project: Students must develop a web based application using the concepts learnt in the courses - Database Management System (21CS505) and Web Programming (21CS602)					

Sl. No.	Elective - II	
	Course Code	Course Title
1.	21CS661	Pattern Recognition
2.	21CS662	Digital Image Processing
3.	21CS663	Wireless Networks
4.	21CS664	Software Architecture
5.	21CS665	C# Programming and .NET
6.	21CS666	Management Information System

Sl. No.	Open Electives	
	Course Code	Course Title
1.	21OECS61	Introduction to Cloud Computing
2.	21OECS62	Introduction to JAVA programming

Admitted Batch: 2021-22
Academic Year : 2024-25
Scheme & Syllabus for IV Year

SEVENTH SEMESTER					
Course Category	Course Code	Course Title	L-T-P (hrs)	Credits	Contact Hours
PCC	21CS701	System Software and Compiler Design	3-1-0	3	4
PCC	21CS702	Cloud Computing	3-0-0	3	3
PCC	21CS703	Network Security and Cyber Law	3-0-0	3	3
PI	21CS704	Main Project Phase - I	0-0-4	2	4
PEC	21CS77X	Elective - III	3-0-0	3	3
PEC	21CS78X	Elective - IV	3-0-0	3	3
OEC	21OECSXX	Open Elective -II	3-0-0	3	3
AEC	21RMIP	Research Methodology & Intellectual Property Rights (Mandate Non-Credit)	2-2-0	AUDIT	4
Total				20	27

Sl. No.	Elective - III		Elective - IV		
	Course Code	Course Title	Sl. No.	Course Code	Course Title
1.	21CS771	Deep Learning	1.	21CS781	Digital Image Analysis
2.	21CS772	Data Science	2.	21CS782	Big Data Analytics
3.	21CS773	Mobile Communications	3.	21CS783	Storage Area Networks
4.	21CS774	Software Testing	4.	21CS784	Green Computing
5.	21CS775	Principles of User Interface Design	5.	21CS785	Advanced Web Technology
6.	21CS776	Project Management and Finance	6.	21CS786	Software Metrics

Sl. No.	Open Electives	
	Course Code	Course Title
1.	21OECS71	Introduction to Python Programming
2.	21OECS72	IOT and its Applications
3.	21OECS73	Big Data Analytics
4.	21OECS74	Web Technology

EIGHTH SEMESTER					
Course Category	Course Code	Course Title	L-T-P	Credits	Contact Hours
PI	21CS801	Main Project Phase - II	0-0-8	4	8
PI	21INT3	Research / Industry Internship - III	0-0-24	12	24
Total				16	32

Title	Engineering Physics		
Course Code	21PH101/201	L-T-P- C	4-0-0- 4
Exam	3 Hrs.	Hours/Week	4
SEE	50 Marks	Total Hours	50
Prerequisite: Knowledge of modes of transfer of heat, Basics of band theory of solids, working principle of capacitors, Fundamentals of translatory motion, oscillatory motion and elasticity, and geometrical optics.			
Course Objective:			
Objective of the course is to make students learn underlying principles and applications of physics in the respective fields and to develop effective solutions for engineering problems.			
Course outcomes: At the end of course, student will be able to:			
#	Course outcomes	Mapping to PO's	
1	Discuss the concepts of wave-particle dualism, electrical conductivity, crystallography, oscillations, and photonics.	1,2	
2	Illustrate the laws of thermal and optical radiations, free electrons, waves, materials science, and rigid body dynamics.	1,2	
3	Solve problems on quantum nature of radiation, interaction of radiation with matter, charge dynamics, and simple harmonic oscillations.	1,2	
4	Interpret the theories of quantum mechanics, free electrons, crystallography, laser, and vibrations in advanced applications.	1,2	
MODULE-1			10 Hrs
Black body radiation spectrum, Wien's law and Rayleigh Jeans law (no derivations). Assumptions of quantum theory of radiation, Planck's law. Photoelectric effect. Application in quantum computing and solar appliances. de Broglie hypothesis of matter waves. Expression for de Broglie wavelength of electron. Applications in SEM, TEM, and advent of nanotechnology (Qualitative). Characteristics of matter waves:Phase velocity and group velocity; derivation of relation between group velocity and particle velocity and speed of light. Heisenberg's uncertainty principle. Its application to show the nonexistence of electron in nucleus of atoms. Wave function. Probability density and normalization of wave function (Max Born's interpretation. Setting up of one-dimensional time independent Schrodinger's wave equation.), eigen values and eigen functions. Application of Schrodinger wave equation- Eigen values and Eigen function for a free particle and a particle in a potential well of infinite depth.			
Numerical problems on de Broglie equations, Photoelectric effect and Eigenvalue equation			

Self-learning topics: Experimental evidences of wave-particle dualism-Compton effect.	
MODULE-2	10 Hrs
Free electrons in metals. Classical free electron theory-assumptions. Drift velocity, Mean free path, Mean collision time, Relaxation time. Expression for electrical conductivity in metals. Failures of classical free electron theory. Quantum free electron theory-assumptions. Fermi energy. Fermi-Dirac distribution function (Fermi factor). Merits of quantum free electron theory. Effects of impurity and temperature on electrical resistivity of metals. Application in material selection and development of conducting wires (transmission lines and winding wires), rheostats and resistors. Semiconductors-effects of impurity and temperature on their electrical resistivity: Applications in development of electronic devices (mention diodes, transistors, LEDs, etc.,) Superconductors. Temperature dependence of electrical resistivity in superconductors. Meissner effect (qualitative). Critical magnetic field. Type I and Type II superconductors. BCS Theory. Applications of superconductors; superconducting magnets, MRI, SQUID (to mention) and Maglev Vehicle (qualitative discussion). <i>Numerical problems on electrical conductivity, Fermi energy, and critical magnetic field</i> Self-learning topics: High temperature superconductors.	
MODULE-3	10 Hrs
Space lattice, Bravais lattice–unit cell, primitive cell. Lattice parameters. Directions and planes, Miller indices. Expression for interplanar spacing. Coordination number. Atomic packing factors (SC,FCC,BCC). Bragg’s law. Bragg’s spectrometer. Application of x-ray spectrometer in material characterizations. Dielectric materials. Polarization and its types. Expression for internal field. Claussius-Mossotti equation (no derivation). Applications of dielectrics in capacitors, transformers, LCDs, and microwave tunable devices. <i>Numerical problems on Miller indices, Interplanar space, Bragg’s law and Claussius-Mossotti equation.</i> Self-learning topics: X-rays: properties and classification	
MODULE-4	10 Hrs
Simple harmonic vibrations. Free vibrations. Damped vibrations-derivation of expressions for displacement of damped harmonic motion. Discussion of types of damped vibrations. Quality factor, relaxation time, logarithmic decrement. Forced vibrations-derivation of expression for amplitude and phase-variation with frequency. Applications in vibration analysis and drones. Resonance. Condition for amplitude resonance. Nondestructive testing and other applications of mechanical and electrical resonance. Rigid body. Moment of inertia. Torsional pendulum-derivation of expression for time period of	

oscillation and mention of its uses. Bending of beams- derivation of expression for bending moment of a beam. Cantilever-derivation for depression of loaded end of a single cantilever. Uses of cantilevers in structures and robotics.

Numerical problems on Amplitude and phase of forced vibrations, time period of oscillation, bending moment and depression/Young's modulus of cantilever.

Self-learning topics:

Sharpness of resonance; effect of damping

MODULE-5

10 Hrs

Interaction of radiation with matter. Expression for energy density in terms of Einstein's coefficients. Requisites of a Laser system. Conditions for laser action. Types of laser devices (to mention Solid, Gas and Semiconductor lasers), Semiconductor Laser- construction and working. Holography. Applications of lasers in industry and defence.

Optical fibers. Construction and principle. Ray propagation mechanism. Angle of acceptance and numerical aperture- their relationship with refractive indices of core and clad and condition for ray propagation. Modes of transmission-V-number and number of modes (expressions). Types of optical fibers. Attenuation. Applications in Point to point communication, computer networking, endoscopy, etc.

Numerical problems on Boltzmann factor, V-number, Numerical aperture, and attenuation.

Self-learning topics:

Development of solid, liquid, and gas lasers. Dispersion in optical fibers

Text Books:

1. Engineering physics: R K Gaur and S L Gupta, ISBN: 9788189928223, Dhanpat Rai Publishing Company (P) Ltd. Edition, 2011
2. Solid state physics: S O Pillai, ISBN-10: 9386070928, New Age International Pvt. Ltd, Eighth edition, 9 January 2018.

Reference Books:

1. Modern Physics, Kenneth S. Krane, ISBN-13: 9781118061145, John Wiley & Sons, Inc., 3rd Edition, 2012.
2. Introduction to Solid State Physics, Charles Kittel, ISBN: 978-1-119-45416-8, 8th Edition, Wiley.
3. Concepts of Modern Physics, Arthur Beiser, ISBN-10 : 0070151555, 5th Edition, Tata McGraw – Hill Edition
4. B.B. Laud - Lasers and non-linear optics, New Age International, ISBN: 9788122430561, 3rd Edition, 2015.
5. Fiber Optics: A K Ghatak and K Thyagarajan, ISBN-13: 978-0521577854, Cambridge University Press India Pvt. Limited, 1998.
6. E-resources; NPTEL courses on Engineering physics.

Title	Calculus and Numerical methods																						
Course Code	21MA102	L-T-P-C	3 – 1 – 0 - 4																				
Exam	3 Hrs.	Hours/Week	5																				
SEE	50 Marks	Total Hours	70																				
Prerequisite: Class 12 calculus Course Objective: To train the students to acquire knowledge in calculus and numerical methods so as to solve basic engineering application problems. Course outcomes: At the end of course, student will be able to: <table> <tr> <th>#</th><th>Course outcomes</th><th>Mapping to PO's</th><th>Mapping to PSO's</th></tr> <tr> <td>1</td><td>Compute Taylor series, partial derivatives and solve simple problems connected with multiple integrals.</td><td>1</td><td>-</td></tr> <tr> <td>2</td><td>Inspect for the maximum output of a function (experimental data), analyse the region of integration connected with multiple integrals so as to determine the area, volume.</td><td>1,2</td><td>-</td></tr> <tr> <td>3</td><td>Apply the numerical methods to compute: The area of a region, root (input) of an equation for the given output, missing input or output of the given experimental data (interpolation/extrapolation).</td><td>1</td><td>-</td></tr> <tr> <td>4</td><td>Model the real life problems/engineering application problems and solve the same.</td><td>1,2</td><td>-</td></tr> </table>				#	Course outcomes	Mapping to PO's	Mapping to PSO's	1	Compute Taylor series, partial derivatives and solve simple problems connected with multiple integrals.	1	-	2	Inspect for the maximum output of a function (experimental data), analyse the region of integration connected with multiple integrals so as to determine the area, volume.	1,2	-	3	Apply the numerical methods to compute: The area of a region, root (input) of an equation for the given output, missing input or output of the given experimental data (interpolation/extrapolation).	1	-	4	Model the real life problems/engineering application problems and solve the same.	1,2	-
#	Course outcomes	Mapping to PO's	Mapping to PSO's																				
1	Compute Taylor series, partial derivatives and solve simple problems connected with multiple integrals.	1	-																				
2	Inspect for the maximum output of a function (experimental data), analyse the region of integration connected with multiple integrals so as to determine the area, volume.	1,2	-																				
3	Apply the numerical methods to compute: The area of a region, root (input) of an equation for the given output, missing input or output of the given experimental data (interpolation/extrapolation).	1	-																				
4	Model the real life problems/engineering application problems and solve the same.	1,2	-																				
MODULE-1			8 Hrs																				
Differential Calculus: Definition of average growth rate and its illustrative examples. Definition of differentiability. Statement of Taylor's theorem, Taylor series for a function of one variable - Illustrative examples. Partial Differentiation: Definition of Partial derivative, Physical and geometrical interpretation of partial differentiation, Application oriented problems on the partial derivatives from engineering field, and Illustrative examples, Statement of Taylor theorem for a function of two variables and illustrative examples on Taylor series. Self-learning topics: Evaluation of Jacobians, Expansion of a function as a Maclaurin series for function of one variable and two variables-illustrative examples.																							
MODULE-2			8 Hrs																				

Differential Calculus: Maxima & Minima for a function of two variables, finding extreme values of the function using Lagrange's multipliers method. Illustrative examples from engineering field. Mathematical modelling through differential equations of first order first degree and solution-modelling of population growth, finding initial velocity of the space vehicle so that it has to escape from earth. Self-learning topics:Modelling of inflected diseases, carbon dating-half-life period, mixing problem involving one tank, two tank.	
MODULE-3	8 Hrs
Numerical Methods: Numerical Solution of algebraic & transcendental equations by Bisection method, Newton Raphson method, Numerical Interpolation-Definition of forward, backward differences, Newton's forward and backward interpolation formulae, Lagrange's interpolation formula. Self-learning topics:Inverse Lagrange's interpolation formula, central difference formula- Bessel's formula, to find the relation between the input and output of an experimental data using suitable interpolation formula.	
MODULE-4	10 Hrs
Multiple Integrals: Double integrals in Cartesian & Polar form, Application to find area. Evaluation of triple integrals in Cartesian & Spherical co-ordinate system. Self-learning topics:Applications to find volume using double integral, to find centre of gravity, moment of inertia using multiple integrals.	
MODULE-5	8 Hrs
Numerical Integration: Evaluation of a line integral by Trapezoidal rule, Simpson's 1/3rd and 3/8th rule, Weddle's rule. Illustrative examples from engineering field. Numerical Double Integration: Computation of a double integral by Simpson's 1/3rd rule. Self-learning topics:To solve the system of non-linear equations by Newton's method.	
Note - Theorems and properties without proof. Applicable to all the Modules. Text Books: 1. Dr. B. S. Grewal, Higher Engineering Mathematics, Khanna Publications, 44th edition, 2016. 2. Erwin Kreyszig, Advanced Engineering Mathematics, Wiley India Pvt. Ltd. 8th Edition (Wiley student edition) 2004.	
<u>Reference Books:</u> 1. Calculus by Thomas Finney, 9th edition, Pearson education, 2002. 2. R K. Jain and S. R. K. Jain & S. R. K. Iyengar, Numerical methods, New age international pvt. Publishers, 6th edition, 2014. 3. P. Bali and Manish Goyal, A textbook of Engineering Mathematics, Laxmi Publications, Reprint, 2010.	

Title	Differential Equations and Vector Calculus																						
Course Code	21MA202	L-T-P-C	3 – 1 – 0 - 4																				
Exam	3 Hrs.	Hours/Week	5																				
SEE	50 Marks	Total Hours	70																				
Prerequisite: Knowledge of Class 12th calculus& vectors Course Objective: To train the students to acquire knowledge in differential equations and vector calculus so as to solve basic engineering application problems/real life application problems. Course outcomes: At the end of course, student will be able to: <table> <tr> <th>#</th><th>Course outcomes</th><th>Mapping to PO's</th><th>Mapping to PSO's</th></tr> <tr> <td>C01</td><td>Apply suitable methods to solve the simple problems of ordinary differential equations /partial differential equations and vector calculus, analytically / numerically</td><td>1</td><td>-</td></tr> <tr> <td>C02</td><td>Examine the higher order problems(more difficult problems) that are connected with differential equations /partial differential equations and solve.</td><td>2</td><td>-</td></tr> <tr> <td>C03</td><td>Introspect the geometry of the region to compute the vector integration problems of gauss divergence theorem, stokes theorem, greens theorem</td><td>2</td><td>-</td></tr> <tr> <td>C04</td><td>Model the real-life problems/ Engineering application problems and hence solve the same.</td><td>1, 2</td><td>-</td></tr> </table>				#	Course outcomes	Mapping to PO's	Mapping to PSO's	C01	Apply suitable methods to solve the simple problems of ordinary differential equations /partial differential equations and vector calculus, analytically / numerically	1	-	C02	Examine the higher order problems(more difficult problems) that are connected with differential equations /partial differential equations and solve.	2	-	C03	Introspect the geometry of the region to compute the vector integration problems of gauss divergence theorem, stokes theorem, greens theorem	2	-	C04	Model the real-life problems/ Engineering application problems and hence solve the same.	1, 2	-
#	Course outcomes	Mapping to PO's	Mapping to PSO's																				
C01	Apply suitable methods to solve the simple problems of ordinary differential equations /partial differential equations and vector calculus, analytically / numerically	1	-																				
C02	Examine the higher order problems(more difficult problems) that are connected with differential equations /partial differential equations and solve.	2	-																				
C03	Introspect the geometry of the region to compute the vector integration problems of gauss divergence theorem, stokes theorem, greens theorem	2	-																				
C04	Model the real-life problems/ Engineering application problems and hence solve the same.	1, 2	-																				
MODULE-1			8 Hrs																				
Differential Equations of First order First Degree (DE): Solution of exact differential equations, Higher Order Differential Equations Linear differential equation with constant coefficients - Solutions of homogeneous equations. Particular solution of non - homogenous differential equations by inverse differential operator method for the following standard forms; exponential, polynomial, trigonometric and their product. Self – study: Linear differential equations, Bernoulli's differential equations.																							
MODULE-2			8 Hrs																				
Differential Equations - Method of variation of parameters to solve linear differential equation with constant coefficients. Applications of first order, first degree differential equations: simple electric circuit, Newton's law of cooling, heat flow problems. Applications of second order, first degree Differential equations - oscillations of a spring-case-modelling of forced oscillations with damping and its solution.																							

Orthogonal trajectories in Cartesian form, illustrative examples. Applications to find the orthogonal trajectories for equi-potential lines in an electric field between two concentric cylinders, streamlines of flow in the channel, curves of constant temperature in a body. Self – study: Matrix method to solve homogeneous differential equations of order 2, degree 1.	
MODULE-3	8 Hrs
Numerical solution of first order, first degree ODE: Taylor series method, Runge-Kutta (RK) method of fourth order, Milne’s predictor corrector methods, Mixing problems involving two tanks-an application connected with simultaneous differential equations. Self-Study - Numerical solution of Simultaneous differential equations, numerical solution of second order differential equations by RK method.	
MODULE-4	8 Hrs
Partial Differential Equations: Solving PDE by variable separable method, To find all possible solutions of one-dimensional wave equation, solution of system of equations by Gauss Seidel iteration method. Numerical solution of a Laplace equation, Poisson equation by finite difference approximation method- using standard five point formula, diagonal formula and iterative formulas. Self – study: To find all possible solutions of one-dimensional heat equation, two dimensional Laplace’s equation.	
MODULE-5	10 Hrs
Vector Calculus: Velocity & acceleration of a vector point function, movement of a force, velocity of a rotating body, rotation of rigid body, Gradient, divergence & curl. Physical & Geometrical Interpretation of dot product, Gradient, divergence & curl, irrotational vectors, illustrative examples from engineering field. Line integrals, surface integrals and volume integrals, Statement of Green’s theorem, Stokes theorem and Illustrative examples from engineering field. Self – study: Gauss divergence theorem, Illustrative examples from engineering field	
Note - Theorems and properties without proof. Applicable to all the Modules. Text Books: 1. Dr. B. S. Grewal, Higher Engineering Mathematics, Khanna Publications, 44th edition, 2016. 2. Erwin Kreyszig, Advanced Engineering Mathematics, Wiley India Pvt. Ltd. 8th Edition (Wiley student edition) 2004.	

Reference Books:

1. Calculus by Thomas Finney, 9th edition, Pearson education, 2002.
2. R K. Jain and S. R. K. Jain & S. R. K. Iyengar, Numerical methods, New age international pvt. Publishers, 6th edition, 2014.
3. N.P. Bali and Manish Goyal, A textbook of Engineering Mathematics, Laxmi Publications, Reprint, 2010.

Title	Basic Electrical Engineering																						
Course Code	21EE103/203	L-T-P	(3-0-0) 3																				
Exam	3 Hrs.	Hours/Week	4																				
SEE	50 Marks	Total Hours	50																				
Prerequisite: Ohms law and Kirchhoff's laws. Current and power in pure R, L and C. Vector algebra. Basic knowledge in magnetic circuits and electromagnetic induction. Course Objective: The student will acquire basic knowledge of electrical power systems, protective devices, electric circuits, measuring systems and machines. Course outcomes: At the end of course, student will be able to: <table border="1"> <thead> <tr> <th>#</th><th>Course outcomes</th><th>Mapping to PO's</th><th>Mapping to PSO's</th></tr> </thead> <tbody> <tr> <td>1</td><td>Explain the basic concepts of electrical generation, transmission, distribution and basic electrical protection devices.</td><td>1,2</td><td>-</td></tr> <tr> <td>2</td><td>Describe the basic principle and construction of analog and digital measuring instruments.</td><td>1,2</td><td>-</td></tr> <tr> <td>3</td><td>Apply the fundamentals of single phase and three phase AC circuits and perform related calculations.</td><td>1,2</td><td>-</td></tr> <tr> <td>4</td><td>Apply the basic concepts of electrical machines.</td><td>1,2</td><td>-</td></tr> </tbody> </table>				#	Course outcomes	Mapping to PO's	Mapping to PSO's	1	Explain the basic concepts of electrical generation, transmission, distribution and basic electrical protection devices.	1,2	-	2	Describe the basic principle and construction of analog and digital measuring instruments.	1,2	-	3	Apply the fundamentals of single phase and three phase AC circuits and perform related calculations.	1,2	-	4	Apply the basic concepts of electrical machines.	1,2	-
#	Course outcomes	Mapping to PO's	Mapping to PSO's																				
1	Explain the basic concepts of electrical generation, transmission, distribution and basic electrical protection devices.	1,2	-																				
2	Describe the basic principle and construction of analog and digital measuring instruments.	1,2	-																				
3	Apply the fundamentals of single phase and three phase AC circuits and perform related calculations.	1,2	-																				
4	Apply the basic concepts of electrical machines.	1,2	-																				
MODULE-1			8 Hrs																				
Electric Energy systems: Significance of electrical energy, sources of energy (Conventional/renewable), Single line/block diagram representation of a typical power system. Brief introduction to the electrical generation, transmission and distribution subsystems indicating typical voltage levels. General concept of earthing, types of earthing, introduction to protective devices- Fuses, MCB, ELCB, MCCB, General types of wires and cables and selection, Electrical Tariff, Elementary calculation of energy consumption.																							

Self-learning topics: General safety precautions in handling electrical equipment.	
MODULE-2	8 Hrs
AC systems: Generation of single/three phase voltages, Instantaneous/average/rms values. Definition of impedance, admittance, real power, reactive power, apparent power and power factor. Analysis of series R-L, R-C, R-L-C circuits, phasor diagrams. Illustrative examples involving series and parallel circuits. Self-learning topics:Measurement of voltage, current, power and power factor in single phase AC system	
MODULE-3	8 Hrs
Three phase systems:Star-Delta connection – calculation of voltage, current and power in a balanced three phase Star-Delta system. Electromechanical / Digital Instruments: Construction, working and principle of operation of Dynamometer type wattmeter. Digital meters, Merits and demerits of digital meters over analog meters, digital multimeter and digital voltmeter. Self-learning topics:Measurement of Voltage, current, power and power factor in three phase AC system. Digital/smart energy meter.	
MODULE-4	8 Hrs
Electrical Machines: Specifications of machines, classification of machines, DC machines - Constructional features, working principle of generator, EMF equation, Working principle of motor, Torque equation, Types of motors and their Voltage & Current relations, applications, Illustrative examples. Self-learning topics:Brushless DC Motors and their application	
MODULE-5	8 Hrs
Transformers: Classification of transformers, applications of each type, construction of core and shell type transformers, principle of operation, EMF Equation, Transformation ratio, Power losses and efficiency, Illustrative examples on EMF equation and efficiency. Induction machines: Induction Motors-Concept of rotating magnetic field, classification (Squirrel cage and Slip ring motors) Principle of operation and Constructional features, Slip and its significance, Single-phase induction motors, working principle, classification and applications. Self-learning topics:Applications of transformers and induction motors, Electric motors used in Electric Vehicles.	
Text Books: 3. Rajendra Prasad, <i>Fundamentals of Electrical Engineering</i>, Prentice-Hall of India Pvt. Ltd., 3rd edition, 2014.	
<u>Reference Books:</u> 1. D. C. Kulshreshtha, <i>Basic Electrical Engineering</i>, McGraw Hill, 2nd edition, 2019 2. E. Hughes, <i>Electrical and Electronics Technology</i>, Pearson Education, 2010	

3. K. Uma Rao and A. Jayalakshmi, *Basic Electrical Engineering*, Pearson Education, 2011.

Title	Engineering Drawing		
Course Code	21MD104/204 A/B	L-T-P-C	(2-0-4-3)
Exam	3 Hrs.	Hours/Week	06
SEE	50 Marks	Total Hours	78

Note – 1) 21MD104/204 A – Manual drawing (for ME/CV)

2) 21MD104/204 B – Computer Aided Engineering Drawing (for ECE/EE/CS/IS/EI)

Course Objective: To introduce the students to “universal language of Engineers” for effective communication and perform drafting exercises of geometrical shapes, solids and machine elements in different systems of Projection using BIS/ISO standards and conventions with the aid of manual drafting and CAD package to effectively take-up the basic industrial/societal drawing needs.

Course Outcomes:

Upon completion of the course, students shall be able to;

#	Course outcomes	Mapping to PO's	Mapping to PSO's
1	visualize geometrical solids in 3D space through exercises in Orthographic Projections	5, 10	-
2	develop the lateral surfaces of geometrical solids and transition pieces		-
3	interpret isometric views and draw orthographic views of machine components and perspective projections		-

Course contents:

MODULE-1	20 Hrs
Principles of orthographic Projections: Different planes of projection and views taking point as an example with explanation about distance of a point from planes of projections. Concept of true length and true inclination of a line (emphasis on practical problems). Projection of Planes by Change of position method only (no combination of planes).	
MODULE-2	24 Hrs

Front, top, profile and auxiliary views of geometric solids resting with their base completely on HP (no other positions).

Development of lateral surfaces, Introduction to Section Planes and section of regular solids, Parallel and Radial line methods.

MODULE-3

18 Hrs

Conversion of Isometric views into Orthographic views: Simple machine components. Isometric projections of geometric solids and simple machine components.

MODULE-4

16 Hrs

Perspective projections of regular geometric solids (1- point and 2-point perspectives).

Text Books:

1. Engineering Drawing: N.D.Bhatt & M.Panchal. 37th Edition 1996, Charotar Publishing House. Gujarat

REFERENCES:

1. Engineering Drawing & Design : Cencil Jensen, Jay D. Helsel, Dennis R. Short, Seventh Edition , Tata McGraw-Hill 2012.
2. Engineering Drawing: K.R. Gopal Krishna, 24th Edition 1999 Subhash Publications, Bangalore.

Title	ENGINEERING MECHANICS		
Course Code	21CV105/ 205	L-T-P	(3-0-0)3
Exam	3 Hrs.	Hours/Week	3
SEE	100 Marks	Total Hours	40 Hours
In the Course, the students are acquainted to analyses and predict various mechanical static and dynamic forces at rest and in motion. Students will accomplish to workout geometrical properties of planar elements and forces in space. Course Outcomes (COs) with mapping shown against the Program Outcomes (POs)}			
Course outcomes: Upon completion of the course, students shall be able to:			
COs	Course outcomes	Mapping to PO's	
1	Develop free body diagrams for different force systems and determine the resultant forces	PO1, PO2	
2	Apply equilibrium equations in statics	PO1, PO2	
3	Determine geometric properties like centroid and moment of inertia for planar elements	PO1, PO2	
4	Apply Newton's law in motion, and recognize different kinds of particle motions	PO1, PO2	
MODULE-1			10 Hrs
Introduction: Definition of force, characteristics of force — Basic idealizations of mechanics like particle, continuum, rigid body — Basic principles of Mechanics — Units of measurements. Coplanar Concurrent Force System: Coplanar forces — Coplanar concurrent force system — Resolution and composition of forces. Static Equilibrium of coplanar concurrent force systems. Coplanar Non-Concurrent Force System: Moment of a force-couple– and its characteristics - Varignon’s Theorem of moments - Composition of coplanar non-concurrent Force Systems - Static equilibrium of coplanar non-concurrent Force Systems.			
MODULE-2			10 Hrs
Support Reaction: Different types of supports. Introduction to statically determinate and indeterminate beams. Determination of support reactions for statically determinate beams subjected to various types of loads. Friction: Concept of frictional force - Types of friction - laws of static friction. Static equilibrium of coplanar force systems involving friction, Friction in Block and ladders.			
MODULE-3			10 Hrs
Centroid and Centre of Gravity: Determination of the position of centroid of plane figures (rectangular, triangular, sector or segment of circle, semi-circular and quadrant) by the method of integration - Determination of the position of centroid of plane figures and built-up sections by the method of moments.			

MODULE-4	10 Hrs
Second Moment of Areas (Moment of inertia): Second moment of an area, moment of inertia, product of inertia, principal moments of inertia (concepts), polar moment of Inertia, Radius of gyration, Parallel axes and perpendicular axes theorems — Determination of moment of inertia and radius of gyration of plane figures (rectangular, triangular, sector or segment of circle, semi-circular and quadrant), composite areas and built- up sections.	
MODULE-5	10 Hrs
Introduction to Dynamics – Classification, Linear & Curvilinear motion, Projectiles, Law of conservation of momentum, Collision of elastic bodies, D’Alembert’s Principle, Kinetics of rigid bodies - Numerical Examples	
SELF LEARNING ACTIVITIES- ENGINEERING MECHANICS • Visit a building and list the structural components and identify the nature of loading on them. The load may be a point load, a UDL, a UVL or a combination of these-discuss with the faculty. • Visit a railway station/Bus stand and list the steel structural components-discuss the loading pattern with the faculty. • Visit an automobile workshop and observe the components of a vehicle and discuss the types of loads with the faculty. • Visit a substation and observe transmission towers, electric poles, guy wires-discuss with the faculty on wind load, tension in wires, forces on guy wires etc.,	
Text Books: 1. I B Prasad, “A Textbook of Applied Mechanics Dynamics and Statics”, Khanna Publishers. New Delhi. ISBN No. 978-81-7409-068-1, 19th Edition, Eleventh Reprint 2016. 2. R. K Bansal, “A Textbook of Engineering Mechanics”, Laxmi Publications, New Delhi.2015.	
Reference Books: 1. Rajashekar S, and Sankar Subramanian, G., “Engineering Mechanics – Statics and Dynamics”, VikasPublications. 2. Timoshenko and Young, “Engineering Mechanics” TMH publishing, India. Statics and Dynamics”.2006. 3. Beer and Johnston, Vector Mechanics for Engineers Statics and Dynamics” (In SI Units) 8th Edition - 2007 – Mc.GrawHillPublications. 4. S.S.Bhavikatti ‘ Engineer Mechanics’ , New Age International Publishers, 5th Edition. 5. Ramamrutham S: “Text book of Applied Mechanics”, Dhanpat Rai and Sons, New India. 1997.	

Course Title	Engineering Physics Laboratory		
Course Code	21PH106/206	L-T-P-C	0-0-2-1
Exam	3 Hrs.	Hours/Week	2
SEE	50 Marks	Total Hours	26
Course Objective: Objective of the course is to make learners able to apply and verify concepts of physics experimentally.			
Course outcomes: At the end of course, student will be able to:			
#	Course Outcomes	Mapping to POs	
1	Demonstrate experimentally the properties of semiconductors, dielectrics, elastic bodies, vibrations, radiation, and optical phenomena.	1,9	
2	Calculate the physical quantities using the experimental data.	1,9	
A. Guided laboratory			
1. Verification of Stefan’s law of radiation			
2. Determination of Planck’s constant using Light Emitting Diodes.			
3. Determination of dielectric constant by charging and discharging of a capacitor.			
4. Estimation of frequencies of vibrating string and AC using Sonometer.			
5. Determination of resonance frequency and inductance using LCR circuits.			
6. Determination of Young’s modulus using single cantilever.			
7. Determination of wavelength of LASER by diffraction technique.			
8. Determination of numerical aperture and modes of transmission of optical fiber.			
B. Open ended laboratory (few examples are given bellow)			
1. Measurement of effective resistance of series combination of three resistors			
2. Measurement of effective capacitance of parallel combination of three capacitors.			
3. Measurement of effective emf of series combination of three cells.			

DESIGN THINKING LABORATORY

Course Code:	21DT108		L-T-P-C	0-0-2-1
Exam Hours:	00		Hours/Week	2
SEE:	00		Total Hours	28 Hours

Course Objective:

Aims to blends theory and practice of design thinking from a systems-level, multi-sector and cross-disciplinary perspective. Focused on Human Centered Design (HCD), Design Thinking and Social Research Method, participants are introduced to a variety of practices, processes and tools that community-change agents use to inform, inspire and create lasting, meaningful solutions.

Course Outcomes (CO's):

Upon Completion of the course, students shall be able to:

CO's	Statement	PO's
1.	Develop awareness regarding the sector in the regions and the sustainable development goals	PO7, PO9, PO10
2.	Acquire essential skills such as interpersonal skills, communication skill to indulge with different stakeholders of the community to identify the problems	PO8, PO9, PO10
3.	Apply research methods to organise, analyse and define the problem	PO2, PO4
4.	Design solutions to the challenges identified along with the stakeholders of the community	PO1, PO6, PO9, PO10
5.	Build prototype using rapid prototyping tools for the ideas that can solve the identified problem	PO1, PO3, PO5, PO11, PO12

Course Contents:

Week	Session	Key Topics
1.	Introduction to Social Innovation Program	• Introduce the Social Innovation Program • Course Outcomes (Knowledge, Skill & Attitude) • Pre-requisites • Deliverables - Journey from Idea to Preincubation • Design challenge - design a better commute for partner
2.	Introduction to Sustainable	• Introduction to the MDGs.

	Development Goals	• Introduction to the SDGs. • What is required to achieve the SDGs by 2030? • SDG on my Plate
3.	Introduction to Design Thinking	• What is Design Thinking? • Phases in Design thinking • When to use Design Thinking? • Design Thinking Challenge
4.	Introduction to Product design and development	• Product Design and Development Cycle • Design Thinking in product design • Design Challenge
5.	Introduction to Research Secondary Research & Primary Research	• How to use Google scholars to find research papers • How to search effectively using Google search engine • Activity- Secondary research on sectors • How to empathise with your users? • Interview Techniques • How to conduct surveys • Field Activity: Identifying an organisation/company/industry for the project and conducting field research (Physically / Online)
6.	Research analysis and designing the problem brief & Ideation	• Cause and effect analysis • Stakeholder analysis • Defining the problem brief • Activity - Analysis of the field activity • Silent Ideation using Miro
7.	Sketching your Ideas	• One point perspective • Two point perspective • Three point perspective
8.	Computer Aided Modelling	• Introduction to Onshape • Creating files for 3D printing • Creating files for Laser Cutting • Creating files for Vinyl Cutting

9.	User Interface Design	• Introduction to User Interface design • Low fidelity prototype, Medium Fidelity, High Fidelity Prototype • Introducing to Adobe XD • Creating screens in Adobe XD
10.	Planning and Prototype	• Project planning using clickup • Create 3D model of the design • 3D print the parts • Laser cut the parts • Assembling the electronics • What is a pitch deck • Introduction to Canva • Creating Pitch decks for the prototypes
11.	Pitch Deck	• What is a pitch deck • Introduction to Canva • Creating Pitch decks for the prototypes
12.	Social Innovation Expo	Social Innovation Project pitching event and exhibition

ENGINEERING CHEMISTRY

Course Code: 21CH101/201
Hours/week: 4

LTPC: 4-0-0-4
SEE: 50 Marks

Exam hours: 3 hours
Total hours: 50

Course Objective: The objective of this course is to build a strong foundation and basic skills in Engineering Chemistry for technological competence in industries.

Course Outcomes:

After the completion of the course, students shall be able to:-

CO1	Describe the construction and working of chemical cells and batteries.	PO1, PO2
CO2	Illustrate the different types of chemical processes and their importance in the field of engineering.	PO1, PO2
CO3	Distinguish among properties & applications of polymers, water and chemical energy.	PO1, PO2

CO4	Apply various principles to solve numerical problems related to chemical energy, water and others.	PO1, PO2
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Course Contents:

MODULE-1

Fuels and combustion

Fuels-Definition, Classification based on the physical state and occurrence with examples, Calorific value –definition, classification - Gross and Net calorific values, units in S.I system. Characteristics of an ideal fuel. Experimental determination of calorific value of a solid fuel using Bomb Calorimeter. Numerical problems on GCV and NCV.

Chemical processing of Petroleum: Petroleum cracking – Definition. Types of cracking-thermal and catalytic cracking. Fluidized catalytic cracking. Reforming of petrol with reactions (Isomerisation, cyclisation, aromatisation and dehydrogenation). Octane number & Cetane number. Knocking of petroleum, knocking mechanism. **Prevention of knocking** – anti knocking agents (TEL & MTBE). Power alcohol, biodiesel and Synthetic petrol -preparation by Bergius Process. **10 hours**

MODULE-2

High Polymers

Introduction, definition and classification with examples. **Glass transition temperature (T_g)** - definition, factors affecting T_g and significances of T_g.

Resins and plastics – Types of plastics- thermoplastics & thermosetting plastics-differences. Compounding of resins in to plastics. Synthesis, properties and Industrial applications of PMMA, Polyurethane, Polycarbonate and Kevlar.

Adhesives –Meaning, Preparation, properties and applications of Epoxy resins & Phenol-formaldehyde resins.

Biodegradable polymers- Introduction, types of biodegradable polymers, preparation, properties and applications of polylactic acid (PLA).

Elastomers- Definition, types-natural and synthetic rubber. Preparation of natural rubber from latex, deficiencies of natural rubber, compounding and vulcanization of natural rubber.

Synthetic rubber- Advantages of synthetic rubber over natural rubber. Preparation, properties and industrial applications of SBR rubber, Thiokol, butyl rubber and silicon rubber.

10 hours

MODULE-3

Water and its treatment

Introduction, sources of water, impurities in water, standards of water for industrial supply. Hardness of water, determination of total hardness by EDTA method. Boiler feed water and boiler problems, **Boiler scales and sludge's**, External treatment of boiler feed water- Hot Lime - Soda process and Ion exchange method. **Internal treatment of water** – phosphate conditioning & Calgon treatment.

Desalination – Meaning, purification of water by reverse osmosis.

Potable water – Meaning, Standards of potable water, treatment of water for town supply. BOD, COD- definition, experimental determination of COD value with problems. **10 hours**

MODULE-4

Electrochemistry

Introduction, electrochemical cells – Definition, Types of electrochemical cells, Construction, working & representation of galvanic cell. Modern sign conventions, single electrode potential, standard electrode potential. E.M.F of a cell, derivation of Nernst Equation.

Concentration cell- Definition with example, derivation of emf of concentration cell. Types of electrodes. **Secondary reference electrodes** – calomel electrode, ion selective electrodes- glass electrode. Determination of pH of a solution using glass electrode. Potentiometric estimation of FAS using $K_2Cr_2O_7$ solution. Numerical problems on E , E^0 , E_{cell} , E^0_{cell} and concentration cells.

Metal finishing

Introduction, technological importance of metal finishing. Significance of polarization, decomposition potential and over voltage.

Electroplating – Definition, factors affecting the nature of electro deposit - metal ion concentration, current density, complexing agents, organic additives, p^H , temperature & throwing power. Electroplating of Copper by cyanide bath method.

Electroless plating - Definition, distinction between electroplating and electroless plating. Advantages of electroless plating. Electroless plating of Nickel. **10 hours**

MODULE-5

Chemistry of nanomaterials (CNM)

Introduction to nanomaterials. Properties of nanomaterials, Classification.

Synthesis: top-down and bottom-up approaches. Chemical methods of synthesis- solution combustion and hydrothermal methods. Characterization techniques like PXRD, SEM, and TEM (only introduction). Applications and disadvantages of nanomaterials.

Battery technology

Batteries- Definition, difference between battery and cell. Battery characteristics. Classification of batteries – primary & secondary batteries. Secondary batteries - construction, working and industrial applications of Lead- acid battery.

Modern batteries: Construction, working and industrial applications of Zinc-air battery, Nickel metal hydride battery and Li batteries.

Fuel Cells- Introduction, definition, construction, working and industrial applications of H_2 - O_2 fuel cell & methanol-oxygen fuel cell. Differences between battery and fuel cell. **10 hours**

TEXT BOOKS

1. Engineering Chemistry by M.M. Uppal, Khanna Publishers (2001 edition).
2. A text Book of Engineering Chemistry- by P C Jain and Monica Jain, Dhanapatrai Publications, New Delhi.(2015 edition)

REFERENCE BOOKS

1. Principles of Physical Chemistry B.R.Puri, L.R.Sharma & M.S.Pathania, S.Nagin Chand &Co.,

(2008 edition).

2. Text Book of Polymer Science by V.R.Gowarikar, N.V.Viswanathan and J.Sreedhar, Wiley-Eastern Ltd (2006 edition).

3. Industrial Chemistry by B.K.Sharma, GOEL Publishing House (2014 edition).

4. Industrial Electrochemistry, Second Edition by Derek Pletcher & Frank C. Walsh publisher: Chapman & Hall, USA (1993 edition)

Title	BASIC ELECTRONICS ENGINEERING																						
Course Code	21EC103/203	L-T-P	3-0-0-3																				
Exam	3 Hrs.	Hours/Week	3																				
SEE	50 Marks	Total Hours	40																				
Prerequisites (if any): Semiconductor diode, Zener diode, Half- Wave rectifier, LC tank circuit, Number Systems – Binary, Octal and Hexadecimal, OR,AND, NOT gates Course Objective: Study of basic electronics devices, circuits and system including digital devices, microprocessor and microcontroller, operational amplifier, communication and display devices. Course outcomes: At the end of course, student will be able to: <table> <tr> <th>#</th><th>Course outcomes</th><th>Mappin g to PO's</th><th>Mappin g to PSO's</th></tr> <tr> <td>1</td><td>Apply the knowledge of semiconductor devices to understand the working of electronics devices and circuits to study their operating conditions.</td><td>1,2,5</td><td>1</td></tr> <tr> <td>2</td><td>Explain the applications of electronic devices and their working.</td><td>1,2</td><td>1</td></tr> <tr> <td>3</td><td>Illustrate the working principles of digital circuits, microprocessor and microcontroller.</td><td>1,2</td><td>1</td></tr> <tr> <td>4</td><td>Describe the working principle of analog devices and communication system.</td><td>1,2</td><td>1</td></tr> </table>				#	Course outcomes	Mappin g to PO's	Mappin g to PSO's	1	Apply the knowledge of semiconductor devices to understand the working of electronics devices and circuits to study their operating conditions.	1,2,5	1	2	Explain the applications of electronic devices and their working.	1,2	1	3	Illustrate the working principles of digital circuits, microprocessor and microcontroller.	1,2	1	4	Describe the working principle of analog devices and communication system.	1,2	1
#	Course outcomes	Mappin g to PO's	Mappin g to PSO's																				
1	Apply the knowledge of semiconductor devices to understand the working of electronics devices and circuits to study their operating conditions.	1,2,5	1																				
2	Explain the applications of electronic devices and their working.	1,2	1																				
3	Illustrate the working principles of digital circuits, microprocessor and microcontroller.	1,2	1																				
4	Describe the working principle of analog devices and communication system.	1,2	1																				
MODULE-1			08 Hrs																				
Analog Devices: BJT: Input and output characteristics of CE configuration, JFET: Working principle, Drain and transfer characteristics, applications. MOSFET: Enhancement and depletion type N-channel, P-channel MOSFETs, Drain / Transfer Characteristics. Other devices: SCR, Photodiode and Solar cell - working principles and applications.																							
MODULE-2			08 Hrs																				
Electronics Circuits: Bridge Full-Wave rectifier: Circuit diagram, working, input and output waveforms, Rectifier with C filter, Zener voltage regulator. Transistor amplifier -Fixed bias, Collector to emitter bias, Voltage-Divider Biasing Circuit, CE amplifier, RC phase shift oscillator, Colpitt's oscillator and Crystal oscillator. (Substitution Problems).																							

MODULE-3	08 Hrs
Digital Electronics: NAND, NOR, Ex-OR gates, Half Adder, Full Adder, Encoder, Decoder, SR Flip Flop, JK Flip-Flop, D-Flip Flop, T- Flip-Flop, Introduction to Microprocessors and Microcontrollers, 8051 Microcontroller architecture.	
MODULE-4	08 Hrs
Operational Amplifier: Characteristics (Ideal and Practical), Inverting and Non-inverting Amplifier, Voltage follower, Summing Amplifier and Subtractor, Numerical examples as applicable. Display instruments: Cathode Ray Oscilloscope, Digital Oscilloscope.	
MODULE-5	08 Hrs
Communication Systems: General communication system, Need for modulation – Amplitude Modulation, Frequency modulation (Substitution Problems). FM Radio, Digital modulation Techniques - ASK and FSK, Cellular Networks, Blue tooth, Internet of Things. (Block Diagram approach only).	
Text Books: 1. David. A. Bell, “Electronic Devices and Circuits”, 5th Edition, 2008, Oxford University Press. 2. M. Morris Mano, “Digital Logic and Computer Design”, 5th edition, 2002, PHI.	
Reference Books: 1. Santiram Kal, “Basic Electronics: Devices, Circuits and IT Fundamentals”, 2009, PHI. 2. Ramakant A. Gayakwad, “Op-amps and linear integrated circuits”, 4th edition, 2000, Prentice Hall. 3. George Kennedy, “Electronic communication systems”, 6th edition, 2017, McGraw Hill India. 4. Muhammad Ali Mazidi, “The 8051 Microcontroller and Embedded Systems using Assembly and C”, 2nd Edition, 2011, Pearson.	

Title	ELEMENTS OF MECHANICAL ENGINEERING		
Course Code	21ME104/204	L-T-P-C	(3-0-0) 3
Exam	3 Hrs.	Hours/Week	03
SEE	50 Marks	Total Hours	39

Course Objective:

To introduce fresh entrants of all undergraduate Programmes the principles and fundamentals of Mechanical Engineering.

Course Outcomes (COs){with mapping shown against the **Program Outcomes (POs)}**

Upon completion of the course, students shall be able to:

#	Course outcomes	Mapping to PO's	Mapping to PSO's
1	Explain the working of steam boilers, steam turbine, gas turbine, hydraulic turbine, IC engines and Electrical Vehicle.	1,2	-
2	Describe the mechanism of power transmissions, bearings, purpose and methods of lubrication.	1,2	-
3	Identify engineering materials, their properties, manufacturing methods, automation of manufacturing process encountered in engineering practice.	1,2	-
4	Differentiate various non conventional machining and working on refrigeration and air conditioning.	1,2	-

Module -I	Hours
Introduction to Mechanical Engineering- Thermal, Design and Manufacturing Engineering. Boilers and Properties of steam: Formation of Steam with constant pressure, Type and properties of steam-Specific volume, Internal energy, and Dryness fraction (numerical problems). Basic principle of water tube boiler & Fire tube boiler, list & functions of boiler mountings & accessories (no construction Details). Steam Turbines –working Principle of Impulse & Reaction turbine. Gas turbines cycles- working principle of Open & Closed cycle gas turbine. Hydraulic turbines –working principle & operation of Impulse & Reaction turbines.	08 Hrs.
Self study: Energy Conversion: Sources of Energy, Energy alternatives Activity: Laboratory visit (Fluid Mechanics and Machinery Laboratory)	
Module - II	
I.C. Engines –Heat Engine, I. C Engines – Classification, Parts, Terminology, 4 stroke petrol and diesel engine. Numerical problems on IP, BP, FP, Efficiency. Electrical Vehicle Technology: Basic concepts Power Transmission: Gears - spur gears, bevel gears, helical gears, worm gear sets, rack and pinion, simple and compound gear trains, Belt and chain drives. Expression of Velocity Ratio for Gears drives, Belt drives, chain drives and gear trains, Numerical problems on Velocity ratio.	08 Hrs.
Self study: Various pollutants from the IC Engine Emission and Effect on the environment. Electric vehicle Components. Activity: Comparative study of I C Engine and Electrical vehicle system. Preparation and Presentation of a Report.	
Module - III	
Lubrication and Bearings: Purpose of lubrication, Types and properties of lubricants,	08 Hrs.

Drop Feed and Splash lubrication, Introduction to Bush bearing and Anti friction Bearings. Materials and Mechanical properties - Engineering Materials; Metals and their alloys, ceramics, polymers, composite materials. Concepts of Stress, Strain, stress-strain diagram for Ductile and Brittle Material When subjected to Tension. Factor of safety (F.O.S.). Numerical problems on Stress, Strain and Change in length.	
Self study: Tension, Compression, and Shear, Strain, stress-strain diagram for Ductile and Brittle Material When subjected to Compression. Activity: Demonstration on Tensile & Compression Testing using UTM.	
Module – IV	
Manufacturing Processes: Introduction and classification of manufacturing processes. Casting-Principles of Sand casting, Permanent Mould casting, Hot chamber Die- casting process, Advantages, Limitation and Applications. Metal Forming: Principles of Rolling, Extrusion (Direct & Indirect Extrusion). Forging operations. Joining process: Brief description of Electric Arc Welding, Gas Welding, Brazing and Soldering.	08 Hrs.
Self study: Plastic processing: Injection Moulding of plastics. Cold chamber Die- casting process. Activity: Workshop visit (Demonstration on Sand mould Casting, Forging and Welding)	
Module - V	
Non-conventional Machining- EDM, ECM and LBM. Automation: Concept of CNC system and Automation, advantages and disadvantages.	07 Hrs.
Refrigeration & Air Conditioning: unit of refrigeration, Refrigeration effect, Ton of Refrigeration, COP. Refrigerants- Types & properties of refrigerants. Parts of refrigerator, Working principle of Vapour compression and Vapour absorption refrigerators. , Introduction to Air conditioning, working principle of room / window Type air conditioning system.	
Self study: Principle of Conventional Machining process, Basic machining operations. Activity: Preparation of report and Presentation on Advanced Manufacturing Methods. Visit to Refrigeration unit.	
TEXT BOOK: 1. Elements of Mechanical Engineering by V. K. Manglik, PHI, 2014, ISBN: 978-81-203-5025-0	
REFERENCES: 1. Elements of Mechanical Engineering - K P Roy, S K H Choudry, A K H Choudry, Roy Media promoters and publishers, Mumbai, 7th edition, ISBN : 4567145216, 1234567145210. 2. Basic Mechanical Engineering - Basanth, Agrwal& C.M. Agrawal 2008. Wiley India Pvt. Ltd 2008, ISBN 13, : 9788126518784 3. An Introduction to Mechanical Engineering.- Jonathan Wickert, 2nd edition, Cengage Learning 2006, ISBN-10: 1-111-57682	

4. Electric and Hybrid vehicles by A. K. Babu Khanna Publications

PROGRAMMING FOR PROBLEM SOLVING			
Course Code	: 21CS105/205		L-T-P-C : 4-0-0-4
Exam. Hours	: 03		Hours / Week : 04
SEE	: 50 Marks		Total hours : 50
Course Objective :	Aims to provide fundamental programming concepts which are essential to develop program for a given problem.		
Course Outcomes (COs) :	Upon Completion of the course, students shall be able to:		
COs	Statement	POs	
1.	Describe the basic concepts of C programming	PO1	
2.	Apply the knowledge of C programming constructs for a given problem	PO1, PO2	
3.	Analyse the given problem to determine the output and correctness of the programs given	PO1, PO2,	
4.	Develop a program to find a solution for the given requirements	PO1, PO2, PO5, PO9, PO10	
Course Contents:			
MODULE – 1			
Algorithm and Flowchart, Introduction: Importance of C, Basic structure of C program, executing a C program, Characters set, C tokens, Variables, Data types, Operators, Expressions, Evaluation of expressions, Operator precedence and associativity, Type conversion,Defining Symbolic constants ,Simple programs. Self Study : Extended data types			
			10 Hrs
MODULE – 2			
Managing Input and Output Operations, Decision making and Branching,elseif...ladder statements, The ?: operator, Simple programs.			
			10 Hrs
MODULE – 3			
Decision making and Looping, Jumps in Loops, programming examples,Nested loops,Arrays: One-dimensional Arrays, Two-dimensional Arrays, , Program to merge two arrays in sorted order, programming examples Self-Study: Multidimensional array			
			10 Hrs
MODULE – 4			
Character Arrays, Arithmetic operation on characters, String handling functions, User-defined Functions, Elements of User defined function, Category of functions, Parameters passing in functions: call by value and call by reference, Nesting of function, Recursion, Passing arrays to functions, Passing strings to functions.			

<i>Self-Study:</i> Additional built-in string functions	
	10 Hrs
MODULE – 5	
Structures: Defining a structure, Declaring a structure variable, Accessing structure members, Structure initialization, Operations on individual members, Arrays of structure, Structure within structure. Pointers: Understanding pointers, Accessing the address of a variable, Declaring pointer variables, Initialization of pointer variables, Accessing a variable through its pointers, Pointer expressions, Pointers increments and scale factor, Pointers and arrays, Pointers as function arguments, Pointers to function.	
	10 Hrs
Text Books:	
1.	Balagurusamy E, “Programming in ANSI C”, 7 th Edition, Tata Mc Graw Hill, 2013.
Reference Books:	
1.	Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language”, 2nd Edition, PHI, 2012.
2.	Programming Techniques through C, M. G. V.Murthy, Pearson Education, 2014
MOOCs	
1.	http://nptel.ac.in/courses/106104128/

ENGINEERING CHEMISTRY LABORATORY

Course Code: 21CH106/206

Exam hours: 3 hours

Hours/week: 2

LTPC: 0-0-2-1

SEE: 50 marks

Course objectives:

To provide students with practical knowledge of quantitative analysis of materials by volumetric and instrumental methods for the determination of constituents present in a sample.

Course outcomes

After the completion of the course students shall be able to:-

CO1	Analyse the hardness of water, CaO in cement, COD of waste water, percentage of iron and copper content in the given samples.	PO1
CO2	Apply the analytical techniques like conductometry, colorometry and potentiometry for accurate chemical analysis.	PO2

LIST OF EXPERIMENTS

PART- A (Volumetric Analysis)

1. Estimation of KMnO_4 using Mohr's salt crystals.

2. Determination of Total hardness of a given sample of hard water using EDTA.
3. Determination of Calcium oxide in the given sample of cement by EDTA method.
4. Determination of percentage of iron in the given sample of haematite ore solution using potassium dichromate crystals by external indicator method.
5. Determination of COD of the given industrial waste water sample.
6. Determination of percentage of copper in brass using standard sodium thiosulphate.

PART- B (Instrumental Methods)

1. Determination of pKa value of weak acid using pH meter.
2. Estimation of FAS using $K_2Cr_2O_7$ by Potentiometric Method.
3. Estimation of copper using Colorimeter.
4. Estimation of HCl using standard NaOH by conductometric method.
5. Determination of viscosity coefficient of a given liquid using Ostwald's Viscometer.

Reference Books:

1. Engineering chemistry lab manual, written by faculty, Department of chemistry, MCE Hassan.
2. Vogels text book of quantitative inorganic analysis, revised by J. Bassett, R.C. Denny, G.H. Jeffery, 4th Ed.
3. Applied chemistry theory and practice by O. P. Vermani and A. K. Narula, second edition.

COMPUTER PROGRAMMING LABORATORY

Course code: 21CS107/207

Hours/week: 2

SEE: 50 Marks

LTPC : 0-0-2-1

Total hours : 28

Exam. Hours: 3

Course Objective: Design, develop and document programs using C.

Course Outcomes (COs):

At the end of the course the student will be able to:

1.	Implement program using C for the given problem.	PO3, PO2
2.	Test and debug a given program for the various test cases.	PO1, PO2

Demonstration Experiments

1.	Demonstration of Scratch Tool.
2.	a. Write a C program to read length of the sides of a triangle and find its area. b. Write a C program to read radius of a circle and find its area and circumference
3.	An employee gets DA 90% of basic salary; HRA 15% of basic salary, CA 5% of basic salary. And also employee has to pay income tax of 10% of gross salary (Gross salary= Basic Salary+ DA+HRA+CA). Write a C program to read the basic salary of an employee and find the take home salary of the employee (Take home salary = gross salary – income tax)
4	Heights of three students in a class are h1, h2 and h3. Write a C program to find the tallest among three students using nested if else statement.
5	Read first name, middle name and last name of a person. Write a C program to concatenate first name with middle name without using built in function. And concatenate the resultant string with last name using built in function.

Guided Laboratory Experiments

1.	Quadratic equation is given by $ax^2+bx+c=0$, where a, b and c are the coefficients provided where $a \neq 0$. The formula to find roots of quadratic equation is $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$. Write a C program to find all the roots and test it for all three cases (based on discriminant value)										
2.	A shop keeper requires performing simple calculations like addition, subtraction, multiplication and modulo division for his daily business. Write a C program to design a simple calculator for shop keeper.										
3.	An electric power distribution company charges its domestic consumers as follows: <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 40%;">Consumption Units</td><td>Rate of Charge</td></tr> <tr> <td>0-200</td><td>Rs. 0.50 per unit</td></tr> <tr> <td>201-400</td><td>Rs.100 plus Rs.0.65 per unit excess of 200</td></tr> <tr> <td>401-600</td><td>Rs.230 plus Rs.0.80 per unit excess of 400</td></tr> <tr> <td>601 and above</td><td>Rs.390 plus Rs.1.00 per unit excess of 600</td></tr> </table> Write a C program to read the customer number, power consumed and display the amount to be paid by the customer.	Consumption Units	Rate of Charge	0-200	Rs. 0.50 per unit	201-400	Rs.100 plus Rs.0.65 per unit excess of 200	401-600	Rs.230 plus Rs.0.80 per unit excess of 400	601 and above	Rs.390 plus Rs.1.00 per unit excess of 600
Consumption Units	Rate of Charge										
0-200	Rs. 0.50 per unit										
201-400	Rs.100 plus Rs.0.65 per unit excess of 200										
401-600	Rs.230 plus Rs.0.80 per unit excess of 400										
601 and above	Rs.390 plus Rs.1.00 per unit excess of 600										

4.	Sine series is given by $x - \frac{x^3}{3!} + \frac{x^5}{5!} - \frac{x^7}{7!} + \dots$ upto n terms, where x is an angle in radian. Write a C program to find sine value for a given angle. Also verify calculated sine value using built in function.[where radian = $\frac{\pi}{180} * degree$]
5.	A person wants to register his newly purchased car. He is passionate to have a palindrome number for car registration. Write a C program to check whether the number allotted is palindrome or not.
6.	Given a list of n student's weight, write a C program to find a student with given weight. If found, display the position of the student in the list else display suitable message.
7.	Given two matrices, write a C program to check whether the matrices are multipliable, if so find the product matrix, otherwise display suitable message
8.	Given a matrix, write a C program to find its transpose. Also find sum of upper triangle elements and sum of lower triangle elements of the transposed matrix.
9.	Write a C program to read a string, find number of vowels and consonants in it.
10.	Given a list of N student's names, write a C program to arrange names in alphabetical order.
11.	Develop a C function to check whether a given number is prime or not. Write a C program to read a range of numbers and print all the prime numbers in that range using the above function.
12.	Develop a function to find the factorial of a given number. Using the above function write a C program to find nCr and nPr where $nCr = \frac{n!}{r!(n-r)!}$ and $nPr = \frac{n!}{(n-r)!}$
13.	Develop a C function to swap two numbers. Write a C program using the above function to sort a given set of integers.
14.	Define a structure data type called student containing members: name, usn, marks of CIE1, CIE2, CIE3, activity1 and activity2. Write a C program that would assign values to individual members and display them along with the total internal marks of all students where total internal marks is sum of best of two CIE marks, activity1 and activity2.
15.	The mark scored by 'n' number of Students for the course 20CS105 in section 'A' is stored in an array. Write a C program to find sum and average of marks using pointers.
Open Ended Laboratory Experiments (Activity)	
1.	Develop a C program to solve a puzzle/game like tic-tac-toe
2.	Develop a C program to check whether two strings are anagram or not
3.	Develop a C program to generate bill in a grocery store
4.	Develop a C program to generate magic square.
5.	Develop a C program to solve 4 queens problem.

Course Title	LINEAR ALGEBRA AND INTEGRAL TRANSFORMS		
Course Code	21MA301	L-T-P-C	(2-1-0)3
Exam Hrs.	3	Hours / Week	3
SEE	50 Marks	Total Hours	40
Course Objective: To introduce linear algebra and transform calculus which may be employed as tools in solving engineering application problems. Course Outcomes (COs): Upon completion of the course, students shall be able to:			
#	Course Outcomes	Mapping to POs	Mapping to PSOs
1.	Utilize the concept of consistency of system of equations to solve the engineering application problems and compute the number of linearly independent vectors.	1, 2	-
2.	Examine for the existence of diagonalization of matrix, find the suitable matrix of transformations so as to get the required image and analyze the system of equations to compute the number of linearly independent Eigen vectors.	1, 2	-
3.	Apply Laplace transform on simple functions and compute Fourier series of periodic functions.	1	-
4.	Examine for adopting different techniques of integration so as to compute Fourier series, Laplace transform of a given function.	1, 2	-
5.	Model the real life problems/engineering application problems and solve the same.	1, 2	-
Course Contents:			
MODULE – 1			10 Hrs
Linear Algebra: Importance of Matrices in engineering. Rank of a matrix. Consistency of nonhomogeneous and homogeneous system of equations, Solution of the system of linear equations by Gauss elimination method and Gauss – Seidel iterative method. Special matrices-matrix of rotation, reflection, translation. To find the matrix of transformation when the image of some points is given. Applications of solution of system of equations to balance the chemical equations. Self Study-- Traffic flow problem, To find the suitable combination of food stuff so as to get the desired nutrients as prescribed by a dietician.			
MODULE – 2			10 Hrs
Linear Algebra: Eigen values and Eigen vectors, properties, Illustrative examples, applications- Stretching of an elastic membrane, to determine the growth of a population model. Role of eigenvalues, eigenvectors in determining natural frequency, mode shapes of equations of motions (Spring mass system). Diagonalization and powers of 3X3 matrices when Eigen values are already given. <i>Self Study-- Stability analysis of differential equations which governs the dynamical systems using the concept of eigen value, eigen vectors.</i>			
MODULE – 3			10 Hrs
Fourier Series: Periodic functions and their graphical representation, to find Fourier series by change of interval method, To represent the experimental data as a Fourier series using the method - Practical harmonic analysis. application of Fourier series in engineering-To represent the signal (wave form) in terms of Fourier series, Fourier series representation for the excitation described by the wave form, graphs of Fourier series approximating the given function. <i>Self Study-- Half range series method.</i>			

MODULE – 4	10 Hrs
Laplace Transforms: Introduction, Definition, Importance of Laplace transform in engineering applications, properties, Laplace transform of standard functions, Laplace transform of derivatives, Laplace transform of periodic functions, unit-step functions. Inverse Laplace Transforms: Definition and general properties, Convolution theorem – illustrative examples, Initial value problems. To solve Applications of initial value problems in engineering using Laplace transform <i>Self Study-- Unit impulse functions (Dirac – delta function). Application of Fourier series to Laplace equation, heat conduction.</i>	
Note - Theorems and properties without proof. Applicable to all the Modules.	
Text Book : 1. Dr. B. S. Grewal, Higher Engineering Mathematics, Khanna Publications, 44th edition, 2016. 2. Linear algebra by David c lay, 3rd edition, Pearson education, 2002.	
Reference Books: 1. R K Jain and S R K Iyengar, Advanced Engineering mathematics by Narosa publishers, 2nd edition, 2005. 2. Calculus by Thomas Finney, 9th edition, Pearson education, 2002. 3. Erwin Kreyszig, Advanced Engineering Mathematics, Wiley India Pvt. Ltd. 8th Edition (Wiley student edition) 2004.	
Activities: 1. To represent Sawtooth periodic motion of a follower operated by a Cam which rotates uniformly, in the form of Fourier series. 2. Application of Fourier series to Laplace equation, heat conduction. 3. Fourier series representation for the excitation described by the wave form, 4. Role of eigenvalues, eigenvectors in determining natural frequency, mode shapes of equations of motions (Spring mass system).	

Course Title	COMPUTER ORGANIZATION		
Course Code	21CS302	L-T-P-C	(3-0-0)3
Exam Hrs.	3	Hours / Week	3
SEE	50 Marks	Total Hours	40
Course Objective: To quantitatively evaluate different designs and organizations of a computer system.			
Course Outcomes (COs): Upon completion of the course, students shall be able to:			
#	Course Outcomes	Mapping to POs	Mapping to PSOs
1.	Explain system architecture and functioning of a digital computer, interrupts, bus structures, memory organization, arithmetic unit operations	1	-
2.	Apply arithmetic operations and cache mapping methods on a given problem	1	-
3.	Analyze interrupts, cache mapping methods and arithmetic circuits	1,2	-
4.	Demonstrate the assembly of a computer system using a simulator	1, 5	-
Course Contents:			
MODULE – 1			10 Hrs
Basic Structures of Computers: Computer types: Functional units: Input unit, Memory unit, Arithmetic & logic unit, output unit, Control unit; Basic Operational Concepts : Bus Structures, Performance: Processor clock, Basic Performance Equation, Pipelining and Superscalar operation, Clock rate, Performance measurement; Historical perspective machine instructions and programs, Data Organization: Numbers, Arithmetic operations and characters, Memory Locations and Addresses: Byte addressability, Big-endian & Little-endian assignments, Word Alignment, Accessing Numbers, Characters & Character strings. <i>Self Study: Generation of Computers</i>			
MODULE – 2			10 Hrs
Input/ Output Organization: Accessing I/O devices, Interrupts: Interrupt Hardware, Enabling & Disabling Interrupt, Handling Multiple devices, Controlling Device Requests, Exceptions; Direct Memory Access: Bus Arbitration. Buses: Synchronous Bus, Asynchronous Bus; PCI bus, SCSI bus, USB. The Memory System: Some Basic Concepts: Semiconductor RAM Memories: Internal Organization of Memory Chips, Static Memories, Asynchronous DRAMs, Synchronous DRAMs.			
MODULE – 3			10 Hrs
The Memory System (continued): Structure of Larger Memories, RAMBUS memory. Read-only Memories: ROM. Speed, Size & Cost. Cache Memories: Mapping functions; Performance considerations: Interleaving, Hit Rate & Miss Penalty Secondary Storage: Magnetic Hard Disks, Optical Disks. <i>Self Study: PROM, EPROM, EEPROM, Flash memory.</i>			
MODULE – 4			10 Hrs
Arithmetic: Addition & Subtraction of Signed Numbers: Addition/Subtraction. Multiplication of Positive numbers: Signed-Operand Multiplication: Booth Algorithm; Fast Multiplication; Bit-pair Recoding of Multipliers; Integer division: Floating-Point Numbers & Operations: IEEE Standard for Floating-Point Numbers, Arithmetic Operations on Floating-Point Numbers, Implementing floating Point Operations.			
Text Book : 1. Carl Hamacher, Z. Vranesic & S. Zaky, Computer Organization , 5 th Edition, McGraw Hill, 2012			

Reference Books:

1. David A. Patterson and John L. Hennessey, Computer Organization and Design, Morgan Kaufmann, Elsevier, Fifth edition, 2014.
2. William Stallings, Computer Organization and Architecture, 9th Edition, Pearson India, 2013
3. Kai Hwang: Advanced Computer Architecture Parallelism, Scalability, Programmability, 2nd Edition, TataMcGraw Hill, 2011.

MOOC:

1. <http://www.nptelvideos.in/2012/11/computer-organization.html>

Course Title	LOGIC DESIGN		
Course Code	21CS303	L-T-P-C	(2-0-1) 3
Exam Hrs.	3	Hours / Week	4
SEE	50 Marks	Total Hours	40
Course Objective: To design and perform analysis of various logical circuits. Course Outcomes (COs) : Upon Completion of the course, students shall be able to:			
#	Course Outcomes	Mapping to PO's	Mapping to PSO's
1.	Describe the various analog and logical circuits	1	-
2.	Apply various techniques to design logic circuits	1	-
3.	Analyze a given logic circuit	1,2	-
4.	Design combinational and sequential logic circuits	1,2,3	-
5.	Implement combination and sequential logic circuits using tools	1,5	1
Course Contents:			
MODULE – 1			10 Hrs
Digital Logic: The Basic Gates: NOT, OR, AND, Universal Logic Gates: NOR, NAND, Positive and Negative Logic. Combinational Logic Circuits: Sum-of-Products Method, Truth Table to Karnaugh Map, Pairs Quads, and Octets, Karnaugh Simplifications - Overlapping, Eliminating Redundant Groups, Simplification of Entered Variable Map, Don't-care Conditions. Product-of-sums Method, Product-of-sums simplifications. Self Study: Simulate the designed circuits using VHDL			
MODULE – 2			10 Hrs
Data-Processing Circuits: Multiplexers, De-multiplexers, 1-of-16 Decoder, Exclusive-or Gates, Parity Generators and Checkers, Magnitude Comparator, Programmable Array Logic, Programmable Logic Arrays. Arithmetic Circuits Arithmetic building blocks, The Adder, subtracter, Fast Adder. Flip-Flops: RS flip flop, Gated Flip Flop, Edge triggered flipflop, D FLIP-FLOP, Edge-triggered D FLIP-FLOP, Edge-triggered FLIP-FLOP, JK Master-slave FLIP-FLOP. Self Study: Simulate the designed circuits using VHDL			
MODULE – 3			10 Hrs
Flip-Flops (continued): Various Representation of FLIP-FLOPs. Analysis of sequential Circuits, Conversion of flipflops. Registers: Types of Registers, Serial In - Serial Out, Serial In - Parallel out, Parallel In - Serial Out, Parallel In - Parallel Out, Applications of Shift Registers. Counters: Asynchronous Counters, Decoding Gates, Synchronous Counters, Changing the Counter Modulus. Self Study: Simulate the designed circuits using VHDL			
MODULE – 4			10 Hrs
Counters (continued): Decade Counters, Counter Design as a Synthesis problem. Design of Synchronous Sequential Circuits: Model Selection, State Transition Diagram, State Synthesis Table, Design equation and circuit diagram. D/A Conversion and A/D Conversion: Variable, Resistor Networks, Binary Ladders, D/A Converters, D/A, A/D Converter- Simultaneous Conversion, A/D Converter-Counter Method. Self Study: Simulate the designed circuits using VHDL			

Text Book:	
1. Donald P Leach, Albert Paul Malvino & Goutam Saha: Digital Principles and Applications, 8 th Edition, Tata McGraw Hill, 2015.	
Reference Books:	
1. Stephen Brown, Zvonko Vranesic: Fundamentals of Digital Logic Design with VHDL, 2 nd Edition, Tata McGraw Hill, 2014.	
2. Ronald J. Tocci, Neal S. Widmer, Gregory L. Moss: Digital Systems Principles and Applications, 10 th Edition, Pearson Education, 2013.	
3. M Morris Mano: Digital Logic and Computer Design, 1 st Edition, Pearson, 2013.	
MOOCs	
1. http://www.nptelvideos.in/search?q=Digital+Logic	
2. http://www.nptelvideos.in/2012/12/digital-circuits-and-systems.html	
Activity:	
1.	In a battery powered computer, the diskette driver motor 1 should be ON iff - There is a diskette in the drive. - The diskette drive door is closed. - Diskette drive motor 2 is not ON. - The battery low signal is not present and - The computer has started a read operation, or the computer has started a write operation. Design a circuit to solve the above scenario using basic gates.
2.	You will gain weight if you eat too much or you do not exercise enough, and your metabolism rate is too low. Design a system such that it alarms you when you gain weight using NAND gates.
3.	The circuit breaker will trip iff - The hair drier is turned ON. - The microwave oven is used. - All the lights in the room are ON or - There is a short circuit in any appliance. Solve the above issue using relevant MUX.
4.	In an automated house, two lamps L1 and L2 are controlled by 3 switches: A, B, C. Any one of the lamps should be ON, following the below conditions. - L1 is ON if switch A and B are open but not C. - L1 is ON if switch B and C are open but not A. - L2 is ON if only switch C is open. - L2 is ON if only switch B is open. - L2 is ON if switch A or C is open, but not B. Design a circuit to make the lamp ON using decoder.
5.	Assume you need to send a secret message consisting of numbers from 1 to 9 and letters from A to F. Secret message is encoded using excess 3 code. Design a circuit using ADDER IC to send a secret message to your friend.
6.	Assume you are generating and transmitting binary data from one place to another. Check whether sent data is transmitted properly or not.
7.	Consider a computer operator who needs to generate a sequence 1011 continuously which is transmitted across the network. Design a circuit to implement this job.
8.	Consider a scenario where in you want to take print out of few selected random pages in sequence numbered from 0 to 15. Design a circuit to achieve this task using J-K Flipflops.
9.	Design and implement a 3-stage up/down counter that counts from a preset value using Decade pre-settable counter ICs. Display the result suitably.

Course Title	DATA STRUCTURES AND ITS APPLICATIONS		
Course Code	21CS304	L-T-P-C	(3-0-0)3
Exam Hrs.	3	Hours / Week	3
SEE	50 Marks	Total Hours	40
Course Objective: To be able to use the appropriate data structures for designing programs. Course Outcomes (COs) : Upon completion of the course, students shall be able to:			
#	Course Outcomes	Mapping to POs	Mapping to PSOs
1.	Describe the basic concept of linear and non-linear data structures.	1	-
2.	Identify the data structures required to solve a given problem.	1	-
3.	Implement operations of linear and non-linear data structures.	2,3	-
4.	Develop a program using linear and non-linear data structures for a given scenario.	2,3	2
Course Contents:			
MODULE – 1			10 Hrs
Introduction: Structures and pointers revisited. Introduction to data structures - Basic terminology, Classification, Operations. The Stack - Definition, Operations, Array Representation of stacks in C Applications of stack: Infix, postfix and prefix, Basic definitions and examples, evaluating a postfix expression, Program to evaluate a postfix expression, converting an expression from infix to postfix, Program in C to convert an expression from infix to postfix.			
MODULE – 2			10 Hrs
Recursion - finding GCD, Fibonacci Series, Recursion Types, Tower of Hanoi, and Recursion versus iteration. Queues - Definition, Array representation of Queues, Operations on Queues, Types of Queues- Circular Queue and its implementation in C, Applications of Queues. Linked List: Introduction to linked list, linked list versus arrays, Singly linked list operations - Insert, Delete, Display, Search and Traverse.			
MODULE – 3			10 Hrs
Other Lists structures: Circular Lists - C Implementation by adding and deleting nodes, Doubly Linked List - C implementation by adding and deleting nodes, Circular doubly linked list, Linked list Applications: Linked Implementation of stacks and Queues, Polynomial Representation.			
MODULE – 4			10 Hrs
Trees: Basic Terminology, Types, Representation using array and Linked List. Creating a binary tree from a general tree, Traversing a binary tree- In-order, Pre-order, Post order, Level order, Constructing a binary tree from traversal results. Efficient Binary Trees: Binary Search trees - definition, Operations- Create, Insert, delete, display, Finding height, Finding number of nodes. AVL trees - Definition, Rotations, Constructing an AVL tree.			
Text Book: 1. Data Structures Using C, Second edition, Reema Thereja, Oxford Press, 2017.			

Reference Books:

1. Yedidyah, Augenstein, Tannenbaum: Data Structures Using C and C++, 2nd Edition, Pearson Education, 2003.
2. Richard F. Gilberg and Behrouz A. Forouzan: Data Structures A Pseudocode Approach with C, Cengage Learning, 2005.
3. Debasis Samanta: Classic Data Structures, 2nd Edition, PHI, 2009.
4. Balagurusamy E, Programming in ANSI C, 7th Edition, Tata McGraw Hill, 2017.

MOOC:

http://nptel.ac.in/keyword_search_result.php?word=data+structures

Course Title	UNIX AND SHELL PROGRAMMING		
Course Code	21CS305	L-T-P-C	(2-0-1) 3
Exam Hrs.	3	Hours / Week	4
SEE	50 Marks	Total Hours	40
Course Objective: To provide the skills needed to develop and customize Unix shell programs and to make effective use of a wide range of UNIX commands. Course Outcomes (COs) : Upon Completion of the course, students shall be able to:			
#	Course Outcomes	Mapping to POs	Mapping to PSOs
1.	Apply the functionality of UNIX commands for a given scenario	1	-
2.	Analyze the commands	2	-
3.	Write shell scripts	3,5	-
4.	Administer UNIX Operating System	1,2	-
Course Contents:			
MODULE – 1			10 Hrs
The Unix Operating System, The UNIX architecture and Command Usage: Features of UNIX, Locating commands, internal and external commands, command structure, Flexibility of command usage. General Purpose Utilities: cal, date, echo, bc, script, passwd, who, uname. The File System: The File, what's in a (file) name?, The Parent-Child relationship, The Home Variable, pwd, cd, mkdir, rmdir, Absolute pathnames, Relative pathnames, ls, The Unix File system. Handling Ordinary Files: cat, cp, rm, mv, more, The lp Subsystem: Printing a File, file, wc, od, cmp, comm., diff.			
MODULE – 2			10 Hrs
Basic File Attributes: ls -l, the -d option, File Ownership, File Permissions, chmod, Directory Permissions, Changing File Ownership. The vi Editor: vi Basics, Input Mode, Saving Text and Quitting, Navigation, Editing text, Undoing Last Editing Instructions, Repeating the last command (.), Searching for the Pattern (/ and ?), Substitution – Search and Replace. The Shell: The Shell's Interpretive Cycle, Shell Offerings, Pattern Matching, Escaping and Quoting, Redirection, Shell Variables.			
MODULE – 3			10 Hrs
The Process: Process Basics, ps, System Processes (-e or -a), Mechanism of Process Creation, Internal and External Command, Process States, Running jobs in Background, nice: job execution with Low priority, Killing processes with signals, at and batch, cron, time. Customizing the Environment: The shells, Environment Variables, The Common Environment Variables, Aliases (bash and ksh), Command History (bash and ksh). More File Attributes: File Systems and Inodes, Hard Links, Symbolic Links and ln, The Directory, umask: Default File and Directory Permissions, Modification and access times, find: Locating Files. Simple Filters: The sample database, pr, head, tail, cut, paste, sort, uniq, tr, Filters using Regular Expressions: grep, grep-searching for a pattern, Basic Regular Expressions (BRE).			
MODULE – 4			10 Hrs
Essential Shell Programming: Shell Scripts, read, Using Command Line Arguments, exit and Exit status of command, The Logical Operators: && and - Conditional Execution, The if conditional, Using test and [] to evaluate Expressions, The case conditional, expr. Essential System Administration: root, the administration privileges, Maintaining security, User management, startup and start down Managing disk space, Device files.			

Text Book: 1. Sumitabha Das, UNIX- Concepts and Applications, Fourth Edition, Tata McGraw Hill, 2017.
Reference Books: 1. Behrouz A. Forouzan and Richard F. Gilberg, UNIX and Shell Programming A Textbook, First edition, Thomson course Technology, 2005. 2. Kenneth Rosen, Douglas Host, James Farber and Richard Rosinski, The Complete Reference- UNIX, Tata McGraw- Hill, Edition 2000.
MOOCs: 1. https://nptel.ac.in/courses/117106113 2. https://www.mooc-list.com/course/command-line-tools-genomic-data-science-coursera
Activity: 1. a. Store the number of files and directories in ./DIR into a file ./DIR/SUBDIR/count.txt b. Delete the contents of ./DIR/SUBDIR/p1.sh file without removing the file. 2. Create a file so that the owner cannot write to it, and the others can just read the file. 3. Make the directory so that you cannot change into the directory. 4. Write a shell script to find the height of a tallest person of given heights of 3 persons.

Course Title	DATA STRUCTURES LABORATORY		
Course Code	21CS306	L-T-P-C	(0-0-1)1
Exam Hrs.	3	Hours / Week	2
SEE	50 Marks	Total Hours	28
Course Objective: Design and implement various data structures.			
Course Outcomes (COs): Upon the completion of the course the students will be able to:			
#	Course Outcomes	Mapping to POs	Mapping to PSOs
1.	Develop, design and document C programs to implement structures and pointers.	1,2,3	-
2.	Illustrate the concepts of data structures: stack, queue, linked list and trees in C using static or dynamic memory allocation and document them.	1,2,3	2
3.	Demonstrate the concept of recursion by developing recursive C programs and document them.	1,2,3	2
Course Contents:			
Practice Programs			
1.	Write a C program to find the maximum and minimum element in an array of n integers. Use only pointers for referencing the array.		
2.	Write a C program for Dynamic Memory allocation of 10 elements and find the largest element.		
3.	Write a C program to represent a complex number using structure variable. Write user defined functions that accept two complex numbers and finds their sum and difference.		
4.	Define a structure Author name with fields: First name, Middle name and Last name. Using the above structure, design another structure Book: ISBN, Author name, Book Title, Price, Publisher, and Edition. Write a function to search a book given the Author name. Using the above function write a C Program to store N books information and display the details of a book given the author name.		
Exercise Programs			
1.	Files are placed one over another in my study room. The file which is at the top is the first one to be removed, i.e. the file which has been placed at the bottom most position remains in the pile of files for the longest period of time. Help me out to add a file and remove the bottom most file from the pile of files.		
2.	Consider an algebraic expression which needs to be evaluated by a computer system. Operating System (OS) consumes less time to evaluate if it is in postfix form of the expression. Thus, help your OS to evaluate by converting the expression into its postfix form.		
3.	Assume you have converted an algebraic expression into its postfix form to process the expression fast. This expression need to be evaluated for a given set of values. Implement the above.		
4.	Assume you come across a toll gate while you are on your way to home town. Illustrate the working of the toll gate using suitable data structure		
5.	a) Suppose you want to search a text book in a huge library where books are arranged in alphabetical order. Optimize your search by using recursion. b) Implement Tower of Hanoi problem using recursion.		
6.	Consider a traffic signal controlled by a computer system. Traffic signal has three colors: Red, yellow and Green. All these glows in a circular fashion based on the traffic. Implement the above using suitable data structure.		

7.	Consider a treasure hunt task where a series of clues are given. Clue1 gives hint to clue2, clue2 Provides hint for clue3 and so on until you can get a hint to the final treasure. Develop an illustration to demonstrate the above scenario.
8.	Assume you have an iPod, where in you have stored plenty of songs so that you get engaged during a long journey. If you want to hear a particular song, you need to use forward button to reach that song and can also traverse back using backward button. Implement the following using relevant data structure.
9.	Your text book contains chapters, sections, subsections, subdivisions, etc. Illustrate this scenario of text book using tree structure.

Course Title	BIOLOGY FOR ENGINEERS		
Course Code	21CS307	L-T-P-C	(0-1-0)1
Exam Hrs.	3	Hours/Week	2
CIE	100 Marks	Total Hours	14
Course Objective: Realization of relation between natural engineering and man-made engineering.			
Course Outcomes: At the end of the course, student will be able:			
#	Course Outcomes	Mapping to POs	Mapping to PSOs
1.	To familiarize engineering students with basic biological concepts	1	-
2.	To involve students in an interdisciplinary vision of biology and engineering	2	-
3.	To gain an appreciation for how biological systems can be designed and engineered to substitute natural system	2	-
4.	To develop biological models using AI tools	3	-
MODULE-1			3 Hrs
Introduction to Human Anatomy: Overview of human anatomy, Structural organization of the human body - cardiovascular system, endocrine system, digestive system, respiratory system, excretory system, lymphatic system, nervous system, muscular system and skeletal system.			
MODULE-2			4 Hrs
Bioinspired Engineering based on human physiology: Circulatory system (artificial heart, pacemaker, stents), Nervous system (Artificial neural network).			
MODULE-3			4 Hrs
Bioinspired Algorithms and Applications: Genetic algorithm, Gene expression modelling. Parallel Genetic Programming: Methodology, History, and Application to Real-Life Problems. Dynamic Updating DNA Computing Algorithms. Beehive: New Ideas for Developing Routing Algorithms Inspired by Honey Bee Behavior.			
MODULE-4			3 Hrs
Artificial Intelligence and Biology: Applications of AI in medical imaging, neural engineering, systems biology, microbiome and data mining.			
Text Books:			
1. Jenkins, C.H. Bioinspired Engineering, NY: Momentum press, 2012 ISBN: 97816066502259			
2. A Practical Guide to Bio-inspired Design, Hashemi Farzaneh, Helena, Lindemann, Udo, Springer 2019, ISBN 978-3-662-57683-0			

Course Title	SAMSKRUTHIKA KANNADA		
Course Code	21KNS	L-T-P-C	(0-1-0)1
CIE	100	Hours/Week	2
Course Outcomes : At the end of course, student will be able to:			
#	Course Outcomes	Mapping to POs	Mapping to PSOs
1.	Understand Government order letters	10	-
2.	Write Government order letters	10	-
Chapter No.	Course Contents		
1.	Kannada bashe – samkshiptha vivarane (Brief Description of Kannada Language)		
2.	Basha prayogadallaguva lopadoshagalu mattu avugula nivaarane (Imperfections in language usage and their remedies)		
3.	Lekhana chinhegalu mattu avugala upayoga (Punctuation marks and their use)		
4.	Patra vyavahaara (Letter correspondences)		
5.	Aadalitha patragalu (Letters of Administration)		
6.	Sarakarada aadesha patragalu (Government order letters)		
7.	Samkshiptha prabhanda rachane, prabhanda mattu bashaantra (precise writing, essays and translation)		
8.	Kannada shabdha sanghaha (Kannada vocabulary)		
9.	Computer haagu maahithi tantrajnana (Computer and Information Technology)		
10.	Paaribhashika aadalitha kannada padagalu mattu taantrika/computer paaribhashika padagalu (Kannada words for administration and computer technology)		

Course Title		BALAKE KANNADA (Kannada for Conversation)		
Course Code		21KNB	L-T-P-C	(0-1-0)1
CIE		100	Hours/Week	2
Course Outcomes: At the end of course student will be able to				
#	Course Outcomes		Mapping to POs	Mapping to PSOs
1.	Understand Kannada language		10	-
2.	Communicate (converse) in Kannada language		10	-
Chapter No.	Course Contents			
1.	Vyavaharika Kannada – Parichaya (Introduction to Vyavaharika Kannada)			
2.	Kannada Aksharamale haagu uchcharane (Kannada Alpabets and Pronunciation)			
3.	Sambhashane gaagi Kannada Padagalu (Kannada Vocabulary for Communication)			
4.	Kannada in Conversations (Sambhashane yalli Kannada)			
5.	Activities in Kannada. (Kannada Sambhashane gaagi Chatuvatikegalu)			
University Guidelines for CIE Procedure:				
a. CIE Marks in Vyavaharika Kannada and Aadalita Kannada shall be the sum of marks prescribed for tests and assignments. Marks prescribed for tests shall be 75 and that for the assessments be 25.				
b. The CIE marks awarded for the tests shall be based on three tests generally conducted at the end of fifth, tenth and fifteenth week of each semester. Each test shall be conducted for a maximum of 25 marks and the final CIE marks shall be the sum of the marks of all the three tests.				
c. The remaining 25 marks shall be awarded based on the evaluation of assignments/unit tests/written quizzes that supports to communication skills as per Bloom’s Revised Taxonomy and Course/programme outcomes.				
d. Final marks awarded shall be the sum of (ii) and (iii) for a maximum of 100 marks.				
e. The candidates shall write the test in Blue Books and also assignments/unit-tests/written quizzes in Blue Books/Notes which shall be preserved by the Principal/Head of the Department for at least six months after the announcement of University results and shall be made available forverification at the direction of the Registrar (Evaluation).				

Course Title	BRIDGE COURSE MATHEMATICS - I		
Course Code	21BCM301	L-T-P-C	(3-0-0)0
Exam Hrs.	3	Hours/Week	3
CIE	100 Marks	Total Hours	40
Course Objective: To introduce simple concepts of calculus and numerical methods.			
Course Outcomes: At the end of the course, student will be able:			
#	Course Outcomes	Mapping to POs	Mapping to PSOs
1.	Solve simple problems on determinants, matrix multiplication, partial differentiation, and integration.	1	-
2.	Compute the roots of transcendental equations and interpolate when the experimental data is given.	1	-
3.	Expand the given function in terms of Taylor/ McLaurin's series.	1	-
Course Contents:			
MODULE-1			10 Hrs
Basic Formulas: Partial fractions. Matrices and determinants: matrix multiplication, evaluation of determinants, finding inverse. Differentiation-I: Review of limit and Continuity, differentiation- Basic formulas, Sum rule, product rule, quotient rule, chain rule and problems. Differentiation-II: Taylor's series, and McLaurin's series of simple functions for single variable, simple problems.			
MODULE-2			10 Hrs
Partial Differentiation: Definition, Illustrative examples on Partial differentiation, Total differentiation, chain rule, Differentiation of composite and implicit functions, Jacobians, illustrative examples and problems, simple problems.			
MODULE-3			10 Hrs
Integration: Basic formulas, Illustrative examples, evaluation of definite integrals, Integration by parts, Bernoulli's rule of Integration. Integral calculus: Reduction formula for functions $\sin^n x$, $\cos^n x$ (without proof), Simple problems, Double & triple integration, simple problems with standard limits.			
MODULE-4			10 Hrs
Numerical Methods: Numerical Solution of algebraic & transcendental equations by Bisection method, Newton Raphson method, Regular Falsi method. Numerical Interpolation: Definition of forward, backward differences, Newton's forward and backward interpolation formulae, Lagrange's interpolation formula, central difference formulas-Bessel and Stirling formulas, illustrative examples.			
Note - Theorems and properties without proof. Applicable to all the units.			
Text Books: 1. Dr. B. S. Grewal, Higher Engineering Mathematics, Khanna Publications, 40th edition (2007). 2. Erwin Kreyszig, Advanced Engineering Mathematics, Tata McGraw Hill, Publications, 8th edition (2007). 3. Calculus by Thomas Finney, 9th edition, Pearson education, 2002. 4. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2010.			

Course Title	STATISTICS AND PROBABILITY		
Course Code	21MA401	L-T-P-C	(2-1-0)3
Exam Hrs.	3	Hours / Week	4
SEE	50 Marks	Total Hours	40
Course Objective: To introduce the concept of probability distribution functions, hypothesis testing, complex analysis so as to apply in engineering application problems.			
Course Outcomes (COs) : Upon Completion of the course, students shall be able to:			
#	Course Outcomes	Mapping to POs	Mapping to PSOs
1.	Fit a suitable curve/regression line for the given experimental data, probability and joint probability.	1	-
2.	Validate an assumption through "hypothesis testing" (that is the assumption is not simply because of chance).	1, 2	-
3.	Analyze the problems connected with probability to apply suitable probability distribution and also, predict the probability in the long run for Markov chain based problems.	1, 2	-
4.	Model real life problems/engineering application problems and solve the same.	1, 2	-
Course Contents:			
MODULE – 1			10 Hrs
Statistics: Correlation –, Karl Pearson coefficient of correlation and Spearman's rank correlation coefficient. Physical interpretation of numerical value of the rank correlation coefficient. Linear Regression analysis (when the experimental output depends on one input). Illustrative examples from engineering field, multiple regression analysis. (When the experimental output depends on two inputs). Probability: Discrete Random Variables: Definitions of PDF & CDF: Expectation and Variance: Binominal pdf- Illustrative examples. <i>Self-study/Applications: Poisson probability distribution function- Illustrative examples.</i>			
MODULE – 2			10 Hrs
Continuous Random Variables: Definition of PDF and CDF, Expectation and Variance, illustrative examples. Shaft conforms, Detection of signal. Probability distribution: Exponential pdf, Normal/Gaussian pdf. Discussion on the choice of PDF. Illustrative examples from engineering field. <i>Self-study/Applications: Uniform pdf, Digital transmission channel.</i>			
MODULE – 3			10 Hrs
Confidence intervals & Hypothesis analysis: Introduction, Testing a hypothesis, central limit theorem-statement, Level of significance, Simple sampling of attributes, confidence intervals, Test of significance for large samples, Comparison of large samples, Student's t-distribution, Chi-square distribution. <i>Self-study/Applications: Current measurement problems, Propellant burning rate, process-capacity problem, drying time problem, Two catalyst effect on chemical reaction.</i>			
MODULE – 4			10 Hrs
Joint Probability Distribution & Stochastic Processes: Concept of joint probability, Joint distributions of discrete random variables, Independent random variables-problems. Joint expectation, co-variance, and correlation. Markov Chains: Introduction, stochastic matrices, fixed probability vectors and regular stochastic matrices. Application of Markov chain to determine the voting tendencies. <i>Self-study/Applications: Estimating the population distribution of a city due to migration.</i>			

Note - Theorems and properties without proof. Applicable to all the modules.

Text Books:

1. Dr. B. S. Grewal, Higher Engineering Mathematics, Khanna Publications, 44th Edition, 2016.
2. Erwin Kreyszig, Advanced Engineering Mathematics, Wiley India Pvt. Ltd., 9th edition, 2014.
3. B V Ramana Higher Engineering Mathematics, Tata McGraw Hill Publications, 2nd edition, 2007.

Reference Books:

1. Scott L. Miller, Donald G. Childers: "Probability and Random Process with application to Signal Processing", Elsevier Academic Press, 2nd Edition, 2013.
2. Statistics for engineers and Scientists, William Navide, Mc-Graw hill education, India Pvt. Ltd., 3rd edition 2014.
3. T. Veerarajan: "Probability, Statistics and Random Process", 3rd Edition, Tata McGraw Hill Co., 2008.
4. Theory and problems of probability, Seymour Lipschutz and Marclarslipson, Schaum out line series, 2nd edition.

Activities:

1. Negative binomial distribution: Failure of server's problems,
2. Negative binomial distribution: Contamination problem, flaws in wires.
3. Exponential distribution: lack of memory property.
4. Continuous random variable: Shaft conforms.
5. Continuous random variable: detection of signal, Digital transmission channel.

Course Title	FINITE AUTOMATA AND FORMAL LANGUAGES		
Course Code	21CS402	L-T-P-C	(2-1-0)3
Exam Hrs.	3	Hours / Week	4
SEE	50 Marks	Total Hours	40
Course Objective: To design grammar production for the programming constructs.			
Course Outcomes (COs) : Upon Completion of the course, students shall be able to:			
#	Course Outcomes	Mapping to POs	Mapping to PSOs
1.	Describe various automata to write grammar productions	1	-
2.	Design automata for a given programming construct	3	-
3.	Apply appropriate automata to obtain grammar productions	1,2	-
4.	Construct a given grammar using a simulation tool	3,5	1
Course Contents:			
MODULE – 1			10 Hrs
Introduction to Finite Automata: Why Study Automata Theory? The Central Concepts of Automata Theory.			
Finite Automata: An Informal Picture of Finite Automata, Deterministic Finite Automata, Non-deterministic Finite Automata, Finite Automata with Epsilon-Transitions.			
MODULE – 2			10 Hrs
Regular Expressions and Languages: Regular Expressions, Finite Automata and Regular Expressions, Applications of Regular Expressions.			
Properties of Regular Languages: Proving Languages Not to Be Regular – Pumping Lemma, Closure Properties of Regular Languages, Equivalence and Minimization of Automata.			
MODULE – 3			10 Hrs
Context-Free Grammars and Languages: Context-Free Grammars, Parse Trees, Applications of Context-Free Grammars, Ambiguity in Grammars and Languages.			
Pushdown Automata: Definition of the Pushdown Automata, The languages of a PDA, Equivalence of PDA's and CFG's, Deterministic Pushdown Automata.			
MODULE – 4			10 Hrs
Properties of Context-Free Languages: Normal Forms for Context-Free Grammars- Eliminating Useless symbols, Eliminating epsilon productions, Eliminating Unit productions, Chomsky Normal Form (CNF), Greibach Normal Form (GNF).			
Introduction to Turing Machines: Problems that Computers cannot Solve, The Turing Machine Programming Techniques for Turing Machines.			
Text Book:			
1. John E. Hopcroft, Rajeev Motwani, Jeffrey D. Ullman, Introduction to Automata Theory, Languages and Computation, 3 rd Edition, Pearson Education, 2013.			
Reference Books:			
1. Peter Linz, An Introduction to Formal Languages and Automata, IV Edition, Narosa Publishing House, 2011.			
2. John C Martin, Introduction to Languages and Automata Theory, 3rd Edition, Tata McGraw-Hill, 2007.			

3. Thomas A. Sudkamp: An Introduction to the Theory of Computer Science, Languages and Machines, 3rd Edition, Pearson Education, 2006.
4. K.L.P. Mishra, Chandrasekaran N: Theory of Computer Science, Automata, Languages and Computation, 3rd Edition, PHI Learning, 2012.

MOOC:

1. <http://elearning.vtu.ac.in>

Activity:

1. Designing of DFA, NFA, Grammar productions using JFLAP tool.
2. Solve real time application problems like:
 - a. Assume a scenario of an online shopping store which uses electronic money. Identify the events and states for this scenario and design an automata individually for
 - Customer
 - Bank
 - Store
 - b. Design an automata to verify the authentication of the user before allowing them to access the confidential information.(Assume the user password is 101101)
 - c. Construct a Finite Automata to search your name in your class attendance list.
 - d. Assume you go for shopping a trouser searching for particular fabric and of particular color. Design grammar for the above scenario.

Course Title	OBJECT ORIENTED PROGRAMMING WITH JAVA		
Course Code	21CS403	L-T-P-C	(3-0-1)4
Exam Hrs.	3	Hours / Week	5
SEE	50 Marks	Total Hours	50
Course Objective: Design and develop java application programs using object-oriented concepts.			
Course Outcomes (COs): Upon completion of the course, students shall be able to:			
#	Course Outcomes	Mapping to POs	Mapping to PSOs
1.	Apply Java constructs for the development of object oriented programs.	1	2
2.	Analyze the given java program to make suitable changes.	2	-
3.	Design a java program for the given problem.	3	2
4.	Conduct practical experiments for demonstrating object oriented concepts through java using IDE.	1, 2, 5	1
Course Contents:			
MODULE – 1			13 Hrs
Java Programming Fundamentals – The Java Language, The key attributes of Object Oriented programming, Java Development Kit (JDK), JVM, A first Simple program, handling syntax errors, The Java Keywords, Identifiers in Java. Introducing Data Types and Operators : Java's Primitive Types, A Closer Look at Variables, The Scope and Lifetime of Variables, operators, Shorthand Assignments, Type conversion in Assignments, Using Cast, Operator Precedence, Expressions. Program Control Statements: Input characters from the Keyboard, if statement, Nested ifs, if-else-if Ladder, Switch Statement, Nested switch statements, for Loop, Enhanced for Loop, While Loop, do-while Loop, Use break, Use continue, Nested Loops. Introducing Classes, Objects and Methods: Class Fundamentals, How Objects are Created, Reference Variables and Assignment, Methods, Returning from a Method, Returning Value, Using Parameters, Constructors, Parameterized Constructors, The new operator Revisited, Garbage Collection. The this Keyword. More Data Types and Operators: Arrays, Multidimensional Arrays, Alternative Array Declaration Syntax, Assigning Array References, Using the Length Member, The For-each Style for Loop, Strings, The Bitwise operators.			
MODULE – 2			12 Hrs
A Closer Look at Methods and Classes: Controlling Access to Class Members, Pass Objects to Methods, How Arguments are passed, Returning Objects, Method Overloading, Overloading Constructors, Recursion, Understanding Static, Introducing Nested and Inner Classes, Varargs: Variable-Length Arguments. Inheritance: Inheritance Basics, Member Access and Inheritance, Constructors and inheritance, Using super to Call Superclass constructors, Using super to Access Superclass Members, Creating a Multilevel Hierarchy, When are Constructors Executed, Superclass References and Subclass Objects, Method Overriding, Overridden Methods support polymorphism, Why overridden Methods, Using Abstract Classes, Using final, The object class.			
MODULE – 3			13 Hrs
Interfaces: Interface Fundamentals, Creating an Interface, Implementing an Interface, Using Interface References, Implementing Multiple Interfaces, Constants in Interfaces, Interfaces can be extended, Nested Interfaces. Packages: Package Fundamentals, Packages and Member Access, Importing Packages, Static import. Exception Handling: The Exception Hierarchy, Exception Handling Fundamentals, The Consequences of an Uncaught Exception, using Multiple catch clauses, Catching subclass Exceptions, try blocks can be nested, Throwing an Exception, A Closer look at Throwable, using finally, using throws, Java's Built-in Exceptions.			
MODULE – 4			12 Hrs
Multithreaded Programming: Multithreading fundamentals, The Thread Class and Runnable			

Interface, Creating Thread, Creating Multiple Threads, Determining When a Thread Ends, Thread Priorities, Synchronization, using Synchronization Methods, The Synchronized Statement, Thread Communication using notify(), wait() and notify All(), suspending, Resuming and stopping Threads. Exploring java.io – The I/O Classes and Interfaces, File, Auto closeable, Closeable and Flushable Interfaces, I/O Exceptions, The Stream Classes, The Byte Streams, The Character Streams, The Console Class.

Text Books :

1. Java Fundamentals, A comprehensive Introduction by Herbert Schildt, Dale Skrien. Tata McGrawHill Edition 2013 (Chapters 1,2,3,4,5,6,7,8,9,10,12)
2. Java – The complete Reference, by Herbert Schildt Eight Edition Tata McGraw Hill Education (Chapter 19).

Reference Books:

1. Programming in JAVA2 by Dr K Somasundaram, Jaico publications
2. Java Programming by Hari Mohan Pandey, Pearson Education, 2012.
3. Deitel and Deitel – "Java How to Program" – 6th Ed. – Pearson.

MOOCs:

1. <http://nptel.ac.in/courses/106106147/>
2. http://www.nptelvideos.com/java/java_video_lectures_tutorials.php
3. https://www.youtube.com/watch?v=0KL_zftem4g
4. <https://www.coursera.org/specializations/object-oriented-programming>

Activity:

Write and execute the following programs in java

1. Design Java application to model Employee of an “ABC” organization. Consider types of employees as : a) Manager b) Sales Person Perform the following:
 - Implement simple inheritance where Employee (employee ID, First Name, Last Name, Current salary) is super class, consider Manager (number of stock options) and SalesPerson (number of sales, commission rate) as subclasses.
 - Define parameterized constructors in class hierarchy.
 - Define methods to display status of employee (override toString()) and increase current payment (salary) as giving bonus by a small amount.
2. Create class Employee with name, Id, cellNum, designation, department, salary permanent (boolean) as members. Also create separate class for member name as EmpName, department as Department and salary as Salary. Members of EmpName are firstName, midName, lastName . Members of Salary are BASIC, DA percent, HRA , PF, insurance. Members of Department are deptName, deptCode. Create an instance of Employee and initialize all its members from user input console. Access the same instance by more than one reference of Employee. Count the number of references and objects being created. [class, reference, objects].
3. Create a super class Bind {x,y} and subclass Bind3d {z} include
 - Parameterized constructor in class Bind to initialize object.
 - Include a method in class Bind to Print data members of object. Override the same method in sub-class and reuse the inherited method in it.
 - Create final static member printArr (Bind[]) which print array of objects. In this method use above method to print member of individual objects of array.
 - Write test class to create to array of Bind3d type. Use the above method to print all the objects of array.

4. A bank maintains two kinds of accounts – Savings account and Current account. The savings account provides simple interest, deposit and withdrawal facilities. The current account only provides deposit and withdrawal facilities. Current account holders should also maintain minimum balance. If balance falls below minimum level a service charge is imposed. Create an abstract class Account that stores customer name, account number type of account and abstract methods. From this derive the classes Curr_Account (double balance, double min_bal, double service Charge / penalty) and Sav_Account (double balance).
- Include the necessary methods in order to achieve the following:
- Define parameterized constructor in a class hierarchy.
 - Allow deposit and update the balance.
 - Display the balance.
 - Compute interest and add to balance.
 - Permit withdrawal and update the balance (check for minimum balance).
 - Apply polymorphism if required for methods in class hierarchy.
 - Create an array of super class / object and populate with subclass objects and call the overridden /object methods.
 - Write a test program to demonstrate the above said implementations.
5. Define an interface EMP Interface (void displayEMP(), void giveBonus (double amount)). Define an abstract class Employee(empID, fName, lName, salary). Define a concrete class Manager (noOfStockOptions), subclass of Employee and define interface methods.
- Perform the following:
- Define appropriate constructors in a class hierarchy.
 - Ensure the bonus amount should not be negative and zero using exception handling mechanism (use throws and throw clauses of exception handling)
 - Create array of interface reference variables and populate with manager objects.
 - Write a test program to implement the above said requirements of interface implementation and exception handling.

Course Title	DESIGN AND ANALYSIS OF ALGORITHMS		
Course Code	21CS404	L-T-P-C	(3-0-0)3
Exam Hrs.	3	Hours / Week	3
SEE	50 Marks	Total Hours	40
Course Objective: To design algorithms using suitable algorithm design method and mathematically analyze it.			
Course Outcomes (COs): Upon completion of the course, students shall be able to:			
#	Course Outcomes	Mapping to POs	Mapping to PSOs
1.	Describe basic knowledge of algorithm analysis, algorithm design strategies, various algorithms, NP problems.	1	-
2.	Apply algorithms to solve a given computational problem.	1	2
3.	Analyze algorithms with respect to time & space complexity	2	2
4.	Design algorithm for a given problem using suitable algorithm design strategy	3	2
Course Contents:			
MODULE – 1			10 Hrs
Introduction: Notion of Algorithm, Fundamentals of Algorithmic Problem Solving, Fundamentals of the Analysis of Algorithm Efficiency: Analysis Framework, Asymptotic Notations and Basic efficiency classes, Mathematical analysis of Recursive and Non-recursive algorithms, Examples. Brute Force: Selection Sort and Bubble Sort, Sequential Search and String Matching. <i>Self Study: Exhaustive Search.</i>			
MODULE – 2			10 Hrs
Divide-and-Conquer: Merge sort, Quick sort, Binary Search. Decrease-and-Conquer: Insertion Sort, Depth First and Breadth First Search, Topological Sorting, Algorithms for Generating Combinatorial Objects.			
MODULE – 3			10 Hrs
Transform-and—Conquer: Presorting, Heaps and Heapsort. Space and Time Tradeoffs: Input Enhancement in String Matching-Horspool algorithm, Hashing. Dynamic Programming: Computing binomial coefficient, Warshall's Algorithm, Floyd's Algorithm, The knapsack Problem <i>Self Study: Memory Functions.</i>			
MODULE – 4			10 Hrs
Greedy Technique: Prim's Algorithm, Kruskal's Algorithm, Dijkstra's Algorithm, Huffman Trees. Limitations of Algorithm Power Lower-bound Arguments, Decision Trees, P, NP and NP-Complete Problems. Coping with the Limitations of Algorithm Power: Backtracking, Branch-and-Bound.			
Text Books :			
1. Anany Levitin, Introduction to The Design and Analysis of Algorithms, 3 rd Edition, Pearson Education, 2012 2. Ellis Horowitz, Sartaj Sahni, Sanguthevar Rajasekaran, Fundamentals of Computer Algorithms, 2 nd Edition, Press 2014.			
Reference Books:			
1. Coremen T.H., Leiserson C. E., and Rivest R. L., Introduction to Algorithms, 3rd edition, PHI, 2015. 2. R.C.T. Lee, S.S. Tseng, R.C. Chang and Y.T.Tsai, Introduction to the Design and Analysis of Algorithms A Strategic Approach, 1st Edition, Tata McGraw Hill, 2005.			

Course Title	MICROCONTROLLER AND EMBEDDED SYSTEMS		
Course Code	21CS405	L-T-P-C	(2-0-1)3
Exam Hrs.	3	Hours/Week	4
SEE	50 Marks	Total Hours	40
Course Objective: To make familiar with programming in microcontroller based embedded systems.			
Course Outcomes(COs): Upon completion of the course, students shall be able to:			
#	Course Outcomes	Mapping to POs	Mapping to PSOs
1.	Describe the concepts of ARM embedded system and its components.	2	-
2.	Design ARM based Assembly Language Programs to solve problems.	1,2,5	2
3.	Illustrate different Hardware interfacing.	1,3,5	2
4.	Develop embedded programs using IDE.	1,2	2
Course Contents:			
MODULE – 1			10 Hrs
ARM Embedded Systems: Microprocessors, Microcontrollers, Microprocessors v/s Microcontrollers, RISC v/s CISC, Harvard v/s Von-Neumann processor, Big-endian v/s Little-endian processors, The ARM Design Philosophy, Embedded System Hardware, and Embedded System Software. What is an Embedded system?, Embedded Vs General computing system, Classification of Embedded systems, Major applications of ES.			
MODULE – 2			10 Hrs
ARM Processor Fundamentals: Registers, Current Program Status Register, Pipeline, Exceptions, Interrupts, and the Vector Table, Core Extensions-cache and tightly coupled memory. Memory-ROM, RAM.			
Introduction to the ARM Instruction Set: Data Processing Instructions-move, barrel shifter, arithmetic, logical, comparison, multiply.			
MODULE – 3			10 Hrs
(Continued) Branch Instructions, Load-store instructions-single register transfer, single register load-store addressing modes, multiple register transfer, stack operations, and swap instruction. Program Status Register Instructions, Loading Constants, and conditional execution.			
MODULE – 4			10 Hrs
Interfacing: Sensors, Actuators, LED interfacing, 7 segment LED display interfacing, stepper motor interfacing, LCD interfacing, Keyboard interfacing, DAC interfacing.			
Text Books :			
1. ARM system developers guide, Andrew N Sloss, Dominic Symes and Chris Wright, Elsevier, Morgan Kaufman publishers, 2008. (1.1 to 1.4, 2.1 to 2.5.1, 3.1 to 3.3, 3.5 to 3.6 (Excluding 3.5.1, 3.5.2), 3.8) 2. Hardware interfacing Manual – Module 4 (Author Shashidhara H V, Malnad College of Engineering, Hassan) 3. Raganandan, An Introduction to ARM System Design, Cengage Publication (5.1, 5.2, 5.3, 5.4, 6.1.1.4, 6.1.1.5, 6.1.1.6, 6.2.1, 6.2.2, 6.3.1, 6.3.2)			
Reference Books:			
1. The Insider's Guide to the ARM7 Based Microcontrollers, Hitex Ltd., 1st edition, 2005 2. Steve Furber, ARM System-on-Chip Architecture, Second Edition, Pearson, 2015 3. Raj Kamal, Embedded System, Tata McGraw-Hill Publishers, 2nd Edition, 2008			
MOOC:			
1. https://onlinecourses.nptel.ac.in/noc18_ec03/preview			

Activity:**Software programs**

1. In a class of strength 20 students, I need to find the tallest guy in the class to reach the projector of the classroom. Help me to identify the tallest guy.
2. To determine the number of ways to distribute 'N' marbles to a group of children you need to find factorial of N. Hence find factorial of a number.
3. To illustrate the working of lookup table in ARM processor, find the square of a number (1 to 10) stored in look-up table.
4. RAM is an important component of microcontroller. To understand how it can be accessed, add an array of 16 bit numbers and store the 32 bit result stored in internal RAM
5. Count the number of ones and zeros in two consecutive memory locations

Hardware interfacing programs

1. Logical controller interfacing (LED)
2. Seven segment interfacing
3. Stepper motor interfacing
4. LCD interfacing
5. Keyboard interfacing
6. DAC controller interfacing

Course Title	SOFTWARE ENGINEERING		
Course Code	21CS406	L-T-P-C	(3-0-0)3
Exam Hrs.	3	Hours / Week	3
SEE	50 Marks	Total Hours	40
Course Objective: To create software development and testing skills and to introduce some major tools for software testing and software project management. Course Outcomes (COs): Upon completion of the course, students shall be able to:			
#	Course Outcomes	Mapping to POs	Mapping to PSOs
1.	Apply software process models for a given software project.	1, 2	-
2.	Depict the role of software project manager.	1, 11	-
3.	Create SRS document for a software product.	1, 2	-
4.	Explore different software architectural styles.	3, 5	-
5.	Exercise approaches to verify and validate a software product.	3, 5	1
Course Contents:			
MODULE – 1			10 Hrs
Introduction: Professional software development, Software engineering Ethics, Case studies, Software processes, Software process models, Process activities, Coping with change, The RU process. Requirements Engineering: Functional and non-functional requirements, the software requirements document, requirements specification, requirements engineering processes, requirements elicitation and analysis, requirements validation.			
MODULE – 2			10 Hrs
Requirements Management and System modeling: Context models, interaction Models, Structural models, Behavioral models, model-driven engineering. Software testing: Development testing, Test-driven development, Release testing, User testing. Software evolution: Evolution processes Program evolution dynamics. Software maintenance, Legacy system management.			
MODULE – 3			10 Hrs
Dependability and Security: Dependability properties, Availability and Reliability, Safety, Security Component- Based Software Engineering: CBSE Process Component composition, Project management: Risk management, Managing People, teamwork, Quality Management: Software quality, Software standards, Reviews and Inspections, Software measurement.			
MODULE – 4			10 Hrs
Agile software development: Agile Methods, plan-drive and agile development, extreme programming, Agile project management, scaling agile methods and metrics. Scrum: an online tool for agile development, Scrum events, Scrum Artifacts. <i>Self Study: Practice to use SCRUM tool for developing and managing software projects.</i>			
Text Book:			
1. Ian Somerville, Software Engineering, Person Education Ltd., 9th Edition, 2013.			
Reference Book:			
1. Roger .S. Pressman, Software Engineering-A Practitioners approach, McGraw-Hill, 7th Edition, 2007.			
MOOCs:			
1. https://www.infoweblinks.com/content/casetools.htm			
2. https://www.mooc-list.com/categories/cs-software-engineering			
3. https://www.scrum.org/resources/what-is-scrum			

Course Title	ALGORITHMS LABORATORY		
Course Code	21CS407	L-T-P-C	(0-0-1)1
Exam Hrs.	3	Hours / Week	2
SEE	50 Marks	Total Hours	28
Course Objective: To demonstrate various algorithmic design techniques.			
Course Outcomes (COs): Upon completion of the course, students shall be able to:			
#	Course Outcomes	Mapping to POs	Mapping to PSOs
1.	Implement various algorithms	1, 3, 9	2
2.	Document the executed algorithms	10	-
Course Contents:			
Practice Programs			
1. Sort a given set of elements using Insertion sort method. 2. Obtain the topological ordering of vertices in a given digraph. 3. Write a program using Transform and Conquer technique for checking whether the digits of mobile number of a person are unique. 4. Find the Binomial Co-efficient using Dynamic Programming 5. Implement computing a mode using pre-sorting method. 6. Implement 0/1 Knapsack problem using dynamic programming.			
Exercise Programs			
1. Employees in an organization need to be grouped for a tournament based on their ages. Sort the ages using Merge sort and find the time required to perform the sorting. 2. Students in a department need to be selected for a high jump competition based on their height (integer values only). Sort the heights of students using Quick sort and find the time required for the Sorting. 3. Print all the nodes reachable from a given starting node in a digraph using BFS and DFS method. 4. Sort a given set of elements using the Heap sort method. 5. Implement Horspool algorithm for String Matching. 6. Consider N cities. The shortest path between every pair of cities needs to be determined. Implement Floyd's algorithm for the All-Pairs- Shortest-Paths problem. Also find transitive closure by implementing Warshall's algorithm 7. There are N different routes from hostel to college. Each route incurs some cost. Find the minimum cost route to reach the college from hostel using Prim's algorithm. 8. Find Minimum Cost Spanning Tree of a given undirected graph using Kruskal's algorithm. 9. Consider the distance between Hassan and N different cities. Every city can be reached from Hassan directly or by using intermediate cities whichever costs less. Find the shortest distance from Hassan to other cities using Dijkstra's algorithm. 10. Implement N-Queens problem using back tracking.			

Course Title	UNIVERSAL HUMAN VALUES		
Course Code	21UHV	L-T-P-C	(0-1-0)1
Exam Hrs.	3	Hours / Week	2
SEE	50 Marks	Total Hours	28
Course Objective: The course aims at the development of the value education by the right understanding through the process of self-exploration (about themselves), family, society and nature/existence. Strengthening of self-reflection by development of commitment and courage to act are presented as the prime focus throughout the course towards qualitative transformation in the life of the student. Course Outcomes (COs): Upon completion of the course, students shall be able to:			
#	Course Outcomes	Mapping to POs	Mapping to PSOs
1.	Start exploring themselves, get comfortable with each other and with the teacher and they start appreciating the need and relevance for the course. Also they are able to note that the natural acceptance (intention) is always for living in harmony.	PO6, PO7, PO8, PO9, PO12	-
2.	Differentiate between the characteristics and activities of different orders and study the mutual fulfillment among them and need to take appropriate steps to ensure right participation (in terms of nurturing, protection and right utilization) in the nature.	PO6, PO7, PO8, PO9, PO12	-
3.	Present sustainable solutions to the problems in society and nature. They are also able to see that these solutions are practicable and draw roadmaps to achieve them.	PO6, PO7, PO8, PO9, PO12	-
Course Contents:			
MODULE – 1			8 Hrs
Introduction to Value Education : Understanding Value Education, Self-exploration as the Process for Value Education, Continuous Happiness and Prosperity – the Basic Human Aspirations, Right Understanding, Relationship and Physical Facility, Happiness and Prosperity – Current Scenario, Method to Fulfill the Basic Human Aspirations.			
MODULE – 2			6 Hrs
Harmony in the Human Being : Understanding Human being as the Co-existence of the Self and the Body, Distinguishing between the Needs of the Self and the Body, The Body as an Instrument of the Self Lecture, Understanding Harmony in the Self Tutorial, Harmony of the Self with the Body to ensure self-regulation and Health.			
MODULE – 3			8 Hrs
Harmony in the Family, Nature and Existence : Harmony in the Family – the Basic Unit of Human Interaction, Values in Human-to- Human Relationship, 'Trust' – the Foundational Value in Relationship, 'Respect' – as the Right Evaluation, Understanding Harmony in the Society, Vision for the Universal Human Order.			
Whole existence as Coexistence: Understanding the harmony in the Nature, Interconnectedness and mutual fulfillment among the four orders of nature recyclability and self-regulation in nature. Include practice sessions to discuss human being as cause of imbalance in nature (film “Home” can be used), pollution, depletion of resources and role of technology etc.			
MODULE – 4			6 Hrs
Implications of the Holistic Understanding – A Look at Professional Ethics : Natural Acceptance of Human Values, Definitiveness of (Ethical) Human Conduct A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order, Competence in Professional Ethics, Holistic Technologies, Production Systems and Management Models, Typical Case Studies, Strategies for Transition towards Value-based Life and Profession.			

Self-Learning Activities:

1. Sharing about Oneself and Exploring Natural Acceptance
2. Exploring Harmony of Self with the Body
3. Exploring the Feeling of Respect
4. Exploring the Four Orders of Nature Lecture and Exploring Co-existence in Existence
5. Exploring Humanistic Models in Education, Exploring Steps of Transition towards Universal Human Order.

Text Books:

1. The Textbook: A Foundation Course in Human Values and Professional Ethics, R R Gaur, R Asthana, G P Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-47-1.
2. The Teacher's Manual Teachers' Manual for A Foundation Course in Human Values and Professional Ethics, R R Gaur, R Asthana, G P Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-53-2.

Reference Books:

1. Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.
2. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
3. The Story of Stuff (Book).
4. The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi
5. Small is Beautiful - E. F Schumacher.
6. Slow is Beautiful - Cecile Andrews
7. Economy of Permanence - J C Kumarappa
8. Bharat Mein Angreji Raj – Pandit Sunderlal.
9. Rediscovering India - by Dharampal
10. Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi.
11. India Wins Freedom - Maulana Abdul Kalam Azad
12. Vivekananda - Romain Rolland (English)
13. Gandhi - Romain Rolland (English)

Course Title	BRIDGE COURSE MATHEMATICS - II		
Course Code	21BCM401	L-T-P-C	(3-0-0)0
Exam Hrs.	3	Hours / Week	3
SEE	50 Marks	Total Hours	40
Course Objective: To introduce simple concepts of differential equations, vector calculus and numerical integration.			
Course Outcomes (COs): Upon completion of the course, students shall be able to:			
#	Course Outcomes	Mapping to POs	Mapping to PSOs
1.	Identify suitable methods to solve the differential equations analytically.	1	-
2.	Solve first order first degree D E, integration problems and simple PDE problems using numerical methods.	1	-
3.	Solve problems on Gradient, Divergence, and Curl of a vector valued function.	1	-
Course Contents:			
MODULE – 1			10 Hrs
Differential Equations: Solution of first order first degree differential equations- Variable separable methods, Homogeneous Equations, Exact differential equations, illustrative examples from engineering field. Linear & Bernoulli's differential equations, Illustrative examples from engineering field.			
MODULE – 2			10 Hrs
Differential Equations: Solution of second and higher order equations with constant coefficient by inverse differential operator method $f(D)y = e^{ax}$, $f(D)y = \cos(ax + b)/\sin(ax + b)$, $f(D) = ax^2 + bx + c$ $f(D)y = e^{ax} \cos(bx + c)/e^{ax} \sin(bx + c)$, $f(D)y = x \cos(ax + b)/x \sin(ax + b)$ (Simple problems). Illustrative examples from engineering field. Numerical solution of first order first degree ordinary differential equations: Taylor series method, Runge-Kutta method of fourth order, Milne's Predictor corrector methods.			
MODULE – 3			10 Hrs
Solution of Partial Differential Equations: Solving PDE by variable separable method, to find all possible solutions of one-dimensional wave equation, one dimensional Heat flow equation and two-dimensional Laplace's equation by the method of separation of variables, numerical solution of Laplace equation by finite difference approximation method using standard five point formula and diagonal five point formula. Numerical solution of poisson equation by finite difference approximation method using standard five-point formula and iterative formulas.			
MODULE – 4			10 Hrs
Numerical Integration: Computation of line integral by trapezoidal rule, Simpsons 1/3rd rule, Weddle's rule, Simpsons 3/8th rule, Illustrative examples from engineering field. Vector Algebra: vector addition, Multiplication (Dot and Cross product), Triple products, vector differentiation, velocity, acceleration of a vector point function, Gradient, divergence, curl.			
Note - Theorems and properties without proof. Applicable to all the units.			
Text Books: 1. Dr. B. S. Grewal, Higher Engineering Mathematics, Khanna Publications, 40th edition (2007). 2. Erwin Kreyszig, Advanced Engineering Mathematics, Tata McGraw Hill Publications, 8th edition (2007).			
Reference Books: 1. Calculus by Thomas Finney, 9 th edition, Pearson education, 2002. 2. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2010.			

Course Title	TECHNOLOGY MANAGEMENT AND ENTREPRENEURSHIP		
Course Code	21CS501	L-T-P-C	(2-1-0)3
Exam Hrs.	3	Hours / Week	3
SEE	50 Marks	Total Hours	40
Course Objective: To lead and manage teams, become entrepreneur and to prepare project proposal.			
Course Outcomes (COs) : Upon completion of the course, students shall be able to:			
#	Course Outcomes	Mapping to POs	Mapping to PSOs
1.	Explore corporate culture and building impressive profiles	10	-
2.	Develop motivation and management skills	9, 11	-
3.	Inculcate skills for Entrepreneurship and Start ups	6, 7	-
4.	Impart knowledge on IPR and R&D in technology industries	1, 4	-
5.	Inculcate the skills of building project proposal	1,11	-
Course Contents:			
MODULE – 1			10Hrs
Planning, and Decision making: Planning: Preview. Nature of planning, the foundation for planning, some planning concepts. Decision Making: Preview. Nature of decision making., types of decisions/decision making. Some human aspects of organizing: Preview. Staffing technical organizations. Authority and power. Delegation.			
MODULE – 2			10Hrs
Motivating & Leading Technical People and Controlling: Motivating and leading technical people: Preview. Motivation. Leadership. Motivating and leading technical professionals (methods). Managing the Research Functions: Preview. Product and technology life cycles. Nature of R & D. Research strategy and organization. Selecting R & D projects. Protection of ideas. Intellectual Property Rights (IPR). Creativity.			
MODULE – 3			10 Hrs
Entrepreneurship: Meaning, evolution of the concept, functions of an Entrepreneur, Characteristics of an Entrepreneur, types of entrepreneurs, Intrapreneur. Entrepreneurship: Concept of Entrepreneurship, Characteristics of Entrepreneurship, Development of Entrepreneurship, Stages in Entrepreneurial process, Role of Entrepreneurs in economic development, Entrepreneurship in India, Entrepreneurship barriers, Women entrepreneur – Concept & steps to develop Women Entrepreneur. Small Scale Industry: Definition, Characteristics, Objectives, Scope and role of SSI in economic Development, Advantages of SSI, Problems of SSI, Steps to start an SSI.			
MODULE – 4			10 Hrs
Government Policy towards SSI; Different Policies of SSI, Introduction to GATT/ WTO. Supporting Agencies of Government for SSI: Meaning, Nature of support; Objectives, functions. Ancillary Industry and Tiny Industry. Institutional Support: Different Schemes: SSIDC, SSIB, DICs/ Single Window Concept, TCOs, ICICI, NSIC, SIDO, IDBI, SIDBI, SFCS, IFCI. Preparation of Project: Meaning, Project identification, Project selection, Project Report - Need of Project, Contents; formulation, Network Analysis Errors of project report, Project Appraisal, Feasibility Study-Market Feasibility Study, Technical Feasibility Study, Financial Feasibility Study, Social Feasibility Study			

Text Books:

1. Daniel Babcock & Lucy C. Morse, “Managing Engineering and Technology”, PHI, 6th edition, 2014.
2. Management and Entrepreneurship- N.V.R Naidu, T Krishna Rao.

Reference Books:

1. Entrepreneurship Development, Small Business Enterprises – Poornima. M. Charantimath, – Pearson Education – 2006.
2. Dynamics of Entrepreneurial Development & Management-Vasant Desai, Himalaya Publishing House.
3. Management Fundamentals - Concepts, Application, Skill Development – Robers Lusier, Thomson.
4. Principles of Management – P. C. Tripathi, P.N. Reddy – Tata McGraw Hill.

MOOCs:

1. <https://nptel.ac.in/courses/110/106/110106141>
2. <https://nptel.ac.in/courses/127/105/127105007>

OPERATING SYSTEMS			
Course Code	: 21CS502		LTPC : (2-1-0)3
Exam. Hours	: 3		Hours / Week :03
SEE	: 50 Marks		Total hours :40
Course Objective : Students should recognize critical resources of operating system and schedule the resources appropriately.			
Course Outcomes (COs) : Upon completion of the course, students shall be able to :			
COs	Statement	Mapping to POs	Mapping to PSOs
1.	Identify fundamental concepts in designing the operating system	1	-
2.	Apply resource management strategies in designing operating system	1, 3	-
3.	Compare various resource scheduling techniques	2, 3	-
4.	Analyse synchronization and deadlock handling mechanisms	2	-
Course Contents:			
MODULE – 1			10 Hrs
Introduction to Operating Systems, System structures: What operating systems do; Computer System organization; Computer System architecture; Operating System structure; Operating System operations; Process management; Memory management; Storage management; Protection and security; Distributed system. Operating System Services; User - Operating System interface; System calls; Types of system calls; System programs; Operating System design and implementation; Operating System structure; Virtual machines.			
MODULE – 2			10 Hrs
Process Management: Process concept; Process scheduling; Operations on processes; Inter-process communication, Threads: Overview; Multithreading models; Threading issues. Process Scheduling: Basic concepts; Scheduling criteria; Scheduling algorithms; Multiple-Processor scheduling; Process Synchronization: Synchronization: The Critical section problem; Peterson's solution; Semaphores; Classical problems of synchronization.			
MODULE – 3			10 Hrs
Deadlocks: Deadlocks: System model; Deadlock characterization; Methods for handling deadlocks; Deadlock prevention; Deadlock avoidance; Deadlock detection and recovery from deadlock. Memory Management: Main Memory: Background; Swapping; Contiguous memory			

allocation; Paging; Segmentation. Virtual Memory Management: Background; Demand paging; Page replacement	
MODULE – 4	10 Hrs
File System Interface: File System: File concept; Access methods; Directory and Disk structure; Mass-Storage Structures: Mass storage structures; Disk structure; Disk attachment; Disk scheduling; Disk management; Swap space management, Protection and Security: Access matrix implementation.	
Text Books:	
1. Abraham Silberschatz, Peter Baer Galvin, Greg Gagne: Operating System Principles, 8 th edition, Wiley-India, 2012.	
Reference Books:	
1. D.M Dhamdhare: Operating systems - A concept based Approach, 2nd Edition, Tata McGraw- Hill, 2002.	
2. P.C.P. Bhatt: Operating Systems, 2nd Edition, PHI, 2006.	
3. Harvey M Deital: Operating systems, 3rd Edition, Pearson Education, 1990.	
MOOCs	
1.	http://nptel.ac.in/courses/106108101/
Activity:	
1	Consider the banking service and use the appropriate scheduling algorithm for the below scenarios. ➤ Physically handicap ➤ Senior citizen ➤ Lapsed token ➤ Based on token ➤ Different services offered by the bank
2	In an online shopping you wish to purchase an item which is out of stock. Apply producer consumer problem technique to address the given scenario
3	Simulate the concept of Dining-Philosophers problem.
4	Assume that your wardrobe is full and you want to replace with new ones. Make use of the available replacement technique and solve

Course Title	DATA COMMUNICATIONS		
Course Code	21CS503	L-T-P-C	(3-0-0)3
Exam Hrs.	3	Hours / Week	3
SEE	50 Marks	Total Hours	40
Course Objective: Students able to gain knowledge of TCP/IP Protocol Model and Functionalities of Data link Layer and Physical Layer			
Course Outcomes (COs): Upon completion of the course, students shall be able to:			
#	Course Outcomes	Mapping to POs	Mapping to PSOs
1.	Perceive the different types of Networks and demonstrate the responsibility each layer of TCP/IP protocol suite.	1,12	-
2.	Enumerate signal transmission along with impairments and performance analysis	2,3	-
3.	Explore the concept of data and signal with different techniques	1,2	-
4.	Review and analysis of bandwidth utilization and transmission media	2,4	-
5.	Investigate the Switching Techniques and addressing methods, and design error detection/ correction algorithms	3,4	-
6.	Formulate and analyse the functionalities of different framing formats, medium Access control Methods	2,4	-
Course Contents:			
MODULE-1			10 Hrs.
Introduction: Data Communications; Networks; Network Types; Network Models: Protocol Layering; TCP / IP Protocol Suite; Physical Layer: Introduction to Physical Layer, Data and Signals; Periodic Analog Signals; Digital Signals; Transmission impairment; Data rate limits;			
MODULE-2			10 Hrs
Digital Transmission: Digital-to-Digital conversion: Line Coding, Line Coding Schemes, Block Coding, and Scrambling; Analog-to-Digital conversion: Pulse Code Modulation (PCM), Delta Modulation(DM); Multiplexing: FDM, WDM, TDM, Multiplexing ; Spread spectrum			
MODULE-3			10 Hrs
Transmission Media: Twisted pair cable, Coaxial cable, Fiber-Optic cable, Radio waves, Microwaves, Infrared. Switching: Introduction; Circuit-Switched Networks: Three Phases and Delay; Packet Switching: Datagram Networks: Virtual Circuit Networks; Introduction to Data-Link Layer: Link-layer Addressing: Three Types of Addresses, Address Resolution Protocol (ARP); Error Detection and Correction: Introduction; Block coding; Error Detection; Cyclic codes: CRC, Polynomials, Cyclic Code Encoder using Polynomials, Cyclic Code Analysis, Checksum: Concept, Other Approaches to the Checksum; Forward Error Correction.			
MODULE-4			10 Hrs
Data Link Control: DLC Services: Framing, Flow and Error control, Connectionless and Connection Oriented; Data Link Layer Protocols: Simple, Stop & Wait, Piggybacking; HDLC; Point to Point Protocol: Services and Framing; Media Access Control: Random Access: ALOHA, CSMA, CSMA/CD, CSMA/CA; Controlled Access: Reservation, Polling, Token Passing; Channelization: FDMA, TDMA, CDMA.			
Text Book:			
1. Behrouz A. Forouzan, “Data Communications and Networking”, Tata McGraw-Hill, 5th Edition. (Chapters 1.1,1.2,.1.3, 2, 3, 4.1,4.2, 6, 7, 8, 9, 10, 11,12, 13)			

Reference Books:

1. Alberto Leon-Garcia and Indra Widjaja, “Communication Networks–Fundamental Concepts and Key architectures”, Tata McGraw- Hill, 2nd Edition.
2. William Stallings, “Data and Computer Communication”, Pearson Education, 8th Edition

MOOC:

1. http://nptel.ac.in/keyword_search_result.php?word=data+communication

Course Title	COMPUTER GRAPHICS AND VISUALIZATION		
Course Code	21CS504	L-T-P-C	(2-0-1)3
Exam Hrs.	3	Hours / Week	4
SEE	50 Marks	Total Hours	40
Course Objective: To learn the concepts of computer graphics to design a 2D and 3D scene using OpenGL. Course Outcomes (COs): Upon completion of the course, students shall be able to:			
#	Course Outcomes	Mapping toPOs	Mapping to PSOs
1.	Identify core concepts of computer graphics with OpenGL.	1, 2	-
2.	Apply concepts of geometric transformations, projections, and illumination to render image.	2, 3, 4, 5	1
3.	Analyze various models and algorithms of illumination	2, 3, 5	-
4.	Design a 2D/3D image using graphical concepts through OpenGL.	1, 2, 3, 4, 5	2
Course Contents:			
MODULE – 1			10 Hrs
Introduction: Applications of computer graphics; A graphics system; Images: Physical and synthetic; Imaging systems; The synthetic camera model; The programmer's interface; Graphics architectures; Graphics Programming; The Sierpinski gasket; Programming two - dimensional applications. The OpenGL: The OpenGL API; Primitives and attributes; Self Study: Pen Plotter Model			
MODULE – 2			10 Hrs
The OpenGL (Continued): Color; Viewing; Control functions; The Gasket program; Polygons and recursion; The three-dimensional gasket. Input and Interaction: Interaction; Input devices; Clients and Servers; Display lists; Display lists and modeling; Programming event-driven input; Menus Self Study: Design of Interactive programs, Animating interactive programs.			
MODULE – 3			10 Hrs
Geometric Objects and Transformations: Three-dimensional primitives; Coordinate systems and frames; Modeling a colored cube; Affine transformations; Rotation, translation and scaling. Transformations in homogeneous coordinates; Concatenation of transformations; OpenGL transformation matrices Self Study: Scalars, points, and vectors, Interactive mesh displays.			
MODULE – 4			10 Hrs
Viewing: Classical and computer viewing; Viewing with a computer; Positioning of the camera; Simple projections; Projections in OpenGL; Hidden-surface removal Lighting and Shading: Light and matter; Light sources; The Phong lighting model; Polygonal shading; Light sources in OpenGL; Specification of materials in OpenGL Implementation: Clipping; Line- Segment Clipping; Bresenham's algorithm Self Study: Approximation of a sphere by recursive subdivisions, Shading of the sphere model			

Text Book:

1. Edward Angel, "Interactive Computer Graphics A Top-Down Approach with OpenGL", Addison-Wesley, 5th Edition, 2013. (Chapters 1, 2, 3, 4, 5, 6, 7)

Reference Books:

1. F.S. Hill, Jr, "Computer Graphics Using OpenGL", Pearson education, 2nd Edition, 2011.
2. James D Foley, Andries Van Dam, Steven K Feiner, John F Hughes, "Computer Graphics", Addison-wesley.

MOOCs:

1. http://nptel.ac.in/keyword_search_result.php?word=computer+graphics?
2. <https://www.edx.org/course/computer-graphics-uc-san-diegox-cse167x-3>
3. <https://www.mooc-list.com/course/interactive-computer-graphics-coursera>

Activity:

1. To recursively subdivide a tetrahedron to form 3D Sierpinski gasket. The number of recursive steps is to be specified by the user
2. To draw a Rocket and allow the user to change the color.
3. To create a house like figure and rotate it about a given fixed point using OpenGL functions
4. To draw a color cube and spin it using OpenGL transformation matrices
5. To create a cylinder and a parallelepiped by extruding a circle and quadrilateral respectively. Allow the user to specify the circle and the quadrilateral.
6. To clip the line PQ against the window coordinates (0,0) and (10,10). P=(-8,2) and Q=(2,14) using Liang Barsky line clipping algorithm.
7. To clip the line segment A(-4,2) and B(-1,7) in a window defined by left bottom corner at (-3,1) and upper right corner at (2,6). Find the visible portion of the line segment using Cohen Sutherland line clipping algorithm.

Course Title	DATABASE MANAGEMENT SYSTEMS		
Course Code	21CS505	L-T-P-C	(3-0-0)3
Exam Hrs.	3	Hours / Week	3
SEE	50 Marks	Total Hours	40
Course Objective: Design a database and write SQL queries.			
Course Outcomes(COs): Upon completion of the course, students shall be able to			
#	Course Outcomes	Mapping to POs	Mapping to PSOs
1	Apply knowledge of database concepts in designing database	1	-
2	Analyze a problem, in identifying appropriate computing requirements to get a solution	2	-
3	Formulate SQL queries to perform database operations	3,12	-
4	Design a database for a given scenario using appropriate techniques	3	-
Course Contents:			
MODULE – 1			10 Hrs
Introduction: Introduction; An example; Characteristics of Database approach; Actors on the screen; Advantages of using DBMS approach. Data models, schemas and instances; Three-schema architecture and data independence; Database languages and interfaces; The database system environment; Centralized and client-server architectures; Classification of Database Management systems. Entity-Relationship Model: Using High-Level Conceptual Data Models for Database Design; An sample Database Application; Entity Types, Entity Sets, Attributes and Keys. Relationship types, Relationship Sets, Roles and Structural Constraints; Weak Entity Types; ER Diagrams, Naming Conventions and Design Issues.			
MODULE – 2			10 Hrs
Relational Model and Relational Algebra: Relational Model Concepts; Relational Model Constraints and Relational Database Schemas; Update Operations, Transactions and dealing with constraint violations; Unary Relational Operations: SELECT and PROJECT; Relational Algebra Operations from Set Theory; Binary Relational Operations: JOIN-variations of JOIN, OUTER JOIN operations. SQL: SQL Data Definition and Data Types; Specifying basic constraints in SQL; Basic Retrieval queries in SQL;			
MODULE – 3			10 Hrs
Continued: Insert,Delete and Update statements in SQL; Additional features of SQL, More complex SQL Retrieval Queries; Views; Schema Change Statements in SQL. Database Design-1: Informal Design Guidelines for Relation Schemas; Functional Dependencies; Normal Forms Based on Primary Keys-1NF,2NF,3NF.			
MODULE – 4			10 Hrs
Database Design-2: Transaction management: The ACID Properties- Consistency and Isolation, Atomicity and Durability; Transactions and Schedules; Concurrent Execution of Transactions- revalorization for Concurrent Execution , Serializability , Anomalies Due to Interleaved Execution , Schedules Involving Aborted Transactions; Concurrency control- 2PL, Serializability, and Recoverability , View Serializability; Introduction to Lock Management - Implementing Lock and Unlock Requests			
Text Books:			
1. Elmasri and Navathe, Fundamentals of Database Systems, Addison-Wesley, 7th Edition, 2015. 2. Raghu Ramakrishnan and Johannes Gehrke, Database Management Systems, McGraw-Hill, 3rd Edition, 2007.			

Reference Books:

1. Silberschatz, Korth and Sudharshan, Database System Concepts, 5th Edition, Mc-Graw Hill, 2006.
2. C.J. Date, A. Kannan, S. Swamynatham, An Introduction to Database Systems, Pearson education, 8th Edition, 2006.

MOOCs:

1. <http://nptel.ac.in/courses/106106093>
2. <https://www.edx.org/course/database-systems-concepts-design-gtx-cs6400x>

Course Code	DATABASE APPLICATIONS LABORATORY		
Course Code	21CS506	L-T-P-C	(0-0-1)1
Exam Hrs.	3	Hours / Week	2
SEE	50 Marks	Total Hours	28
Course Objective: Develop database application for real world scenarios.			
Course Outcomes(COs): Upon Completion of the course, students shall be able to:			
#	Course Outcomes	Mapping to POs	Mapping to PSOs
1	Design and create relational schema	3,5	-
2	Implement queries using SQL	3	-
3	Design and develop database applications	3,5,6,8	1
EXERCISE PROGRAMS			
1. Consider the following schema: EMPLOYEE (EmpNo, EmpName, Gender, Salary, Address, DNo, age) DEPARTMENT (DeptNo, DeptName, Location) Create Employee table with following constraints: Make EmpNo as Primary key, do not allow EmpName, Gender, Salary and Address to have null values, set the default salary value to Rs. 1000. Create Department table with following: Make DeptNo as Primary key, Make DeptName as candidate key, make DNo of Employee as foreign key which refers to DeptNo of Department Design a database to satisfy the above requirements and answer following queries: - List all the employees who are above 40 years of age - List the employees who work in a particular department - List the female employees who are 30 years of age and drawing salary >8000			
2. Consider the following schema: SUPPLIERS (Sid: integer, sname: string, address: string) PARTS (PID: integer, pname: string, color: string) CATALOG (Sid: integer, PID: integer, cost: real) Design a database to satisfy the above requirements and answer the following queries: - Find the names of parts for which there is some supplier. - Find the names of suppliers who supply every part. - Find the id's of suppliers who supply only red parts.			
3. Consider the following relations for an order processing database application in a company. CUSTOMER (cust #: int , cname: string, city: string) ORDER (order #: int, odate: date, cust #: int, ord-Amt: int) ORDER _ ITEM (order #: int, Item #:int, qty: int) ITEM (item # : int, unit price: int) SHIPMENT (order #: int, warehouse#: int, ship-date: date) WAREHOUSE (warehouse #: int, city: string). Create the above tables by properly specifying the primary keys and the foreign keys. Enter at least five tuples for each relation.			

a. Produce a listing: CUST#, #of orders, AVG_ORDER_AMT, where the middle column is the total numbers of orders by the customer and the last column is the average order amount for that customer. b. Create a view for average price of each item as average_item_price and number of quantities of that item as number_of_items.
4. Consider the following database of student enrolment in courses & books adopted for each course. STUDENT (Regno: string, name: string, major: string, bdate: date) COURSE (Course #: int, Cname: string, dept: string) ENROLL (Regno: string, course#: int, SEM: int, marks: int) BOOK _ ADOPTION (Course#: int, SEM: int, book-ISBN: int) TEXT (Book-ISBN: int, book-title: string, publisher: string, author: string) Create the above tables by properly specifying the primary keys and the foreign keys. Enter at least five tuples for each relation. a. Demonstrate how you add a new text book to the database and make this book beadopted by some department. b. Produce a list of text books (include Course #, Book-ISBN, Book-title) in the alphabetical order for courses offered by the 'CS' department. c. List any department that has all its adopted books published by a specific publisher.
5. Consider the Insurance database given below. The primary keys are underlined and the data types are specified. PERSON (<u>driver – id #</u>: String, name: string, address: string) CAR (<u>Regno#</u>: string, model:string, year: int) ACCIDENT (<u>report-number#</u>: int, <u>date_of_acc</u>: date, location: string) OWNS (<u>driver-id #</u>:string, Regno:string) PARTICIPATED (<u>driver-id</u>: string, Regno:string, <u>report-number</u>:int, damage amount:int). Create the above tables by properly specifying the primary keys and the foreign keys. Enter atleast five tuples for each relation. a. Demonstrate how you i. Update the damage amount for the car with report number 12. ii. Add a new accident to the database. b. Find the name of the person who is involved in maximum number of accidents in theyear 2007. c. Find the number of accidents in which cars belonging to a specific model were involved.
6. Consider the following relations for the details maintained by a book dealer. AUTHOR (Author-id: int, Name: string, City: string, Country: string) PUBLISHER (Publisher-id: int, Name: string, City: string, Country: string) CATALOG (Book-id: int, title: string, author-id: int, Publisher-id: int, Category-id: int, Year: int, Price:int) CATEGORY (Category-id: int, Description: string) ORDER-DETAILS (Order-no : int, Book-id: int, Quantity: int) a. Create the above tables by properly specifying the primary keys and the foreign keys. b. Enter at least five tuples for each relation. c. Give the details of the authors who have 2 or more books in the catalog and the price of the books is greater than the average price of the books in the catalog and the year of publication is after 2000. d. Find the author of the book which has maximum sales. e. Demonstrate how you increase the price of books published by a specific publisher by 10%.

7. Consider a Video-Parlor database. The database holds members details, details of videos, details of copies of videos for rent, and details of video rentals by members. Design a database satisfying the above requirements and solve following queries as outlined below using SQL. - List only videos in the Children category with a daily rental rate of less than £4.00 and sorted according to video title. - List the catalog No, title and category of the Video table, ordered by video title - List all videos with a certification of “PG” or “18” in the Video table.
8. Design a relational database for a real estate agency. It should store information about houses for sale, seller information, Buyer information, agents information (who can act on behalf of either the buyer or the seller), and the sale of houses. Answer the following queries in SQL. - What are the ids, addresses, asking_price, and selling_price of all houses that sold for less than the asking price? - What are names of all of (prospective) buyers who have not bought a house? Each name should appear only once. - Find the addresses and asking prices of all houses that have at least 3 bedrooms and two bathrooms that have not sold. Each address, asking price pair should appear only once.
Activity: Design database for applications.

Course Title	R Programming		
Course Code	21CS507A	L-T-P-C	(0-0-1)1
Exam Hrs.	3	Hours / Week	2
SEE	50 Marks	Total Hours	15
Course Objective: To learn and Practice Programming techniques using R Programming. Course Outcomes (COs): Upon completion of the course, students shall be able to:			
#	Course Outcomes	Mapping to POs	Mapping to PSOs
1.	To understand the fundamental syntax of R and demonstration through readings and writing R code	1, 2	-
2.	To apply critical programming language concepts such as data types, iteration, control structures and functions by writing R programs and through examples	2, 3,4,5	-
3.	To import a variety of data formats into R using R-Studio	1, 2	-
Course Contents:			
Practice Programs:			
1. Installation of R Studio 2. Write an R Program to take input from the user (name and age) and display the values. Also print the version of R installation. 3. Write an R Program to get the details of the objects in memory. 4. Write an R Program to create a sequence of numbers from 20 to 50 and find the mean and product of numbers from 20 to 60 and sum of numbers from 51 to 91. 5. Write an R Program to multiply two vectors of integer's type and length 3.			
Guided Laboratory Experiments			
1. Write a program to check a year (integer) entered by the user is a leap year or not. 2. A shop keeper requires performing simple calculations like addition, subtraction, multiplication and modulo division for his daily business. Develop R program to perform these operation using switch cases and functions. 3. Write a program to perform searching within a list (1 to 5). If the number is found in the list, print that the search is successful otherwise print that the number is not in the list. 4. As a data analyst, you are tasked to analyze the three CIE conducted for 40 students. Find the total marks, average, maximum marks and minimum marks of six subjects. 5. As a data scientist, you are tasked with handling various matrices for a research project. Develop an R program to create three different matrices and populate them with data. For 5x4 and 3x3 matrix, fill the data by rows, and for the 2x2 matrix, fill the data by columns. Example: Matrix 1: 2x2 matrix with labels The matrix represents data gathered from two different subjects (rows) and two measurements (columns). Each row corresponds to a subject, and each column represents a different measurement (e.g., heart rate, blood pressure). 6. As a data analyst, you are responsible for merging data from two different departments within your organization. Each department has collected data in the form of matrices with the same number of columns but different numbers of rows. Develop an R program to concatenate these two matrices while preserving the column structure. 7. In your role as a data analyst at the healthcare organization, you have been tasked with organizing patient data into a structured format. You have collected four sets of data, each stored as a			

separate vector, which includes patient details such as patient ID, name, age, and medical condition. Write an R program to create data frame from these four vectors. After creating the data frame, you must save the data frame into a file to ensure data preservation and future access.

8. As a programmer at the digital security company, you have been assigned a critical task related to number encryption. Your task is to create an R program that calculates the sum of the digits of a given number using various looping techniques.
9. Create employee .CSV file having attributes such as Eid, name, salary, start_date and department. Perform various operation such as Reading, writing and analyzing (no. of rows and columns, max salary with and without person, specific department, joined on or before specific date)
10. As a teacher at a high school, you recently conducted a quiz for your students on five different subjects: Mathematics, English, Science, History, and Geography. Write an R program to create a simple bar plot for these five subjects to present the performance of your students.

Course Title	UI/UX LABORATORY		
Course Code	21CS507B	L-T-P-C	(0-0-1)1
Exam Hrs.	3	Hours / Week	3
SEE	50 Marks	Total Hours	15
Course Objective: To gain a solid understanding of fundamental UI/UX principles, including visual design, user-centered design, usability, and user experience.			
Course Outcomes (COs): Upon completion of the course, students shall be able to:			
#	Course Outcomes	Mapping to POs	Mapping to PSOs
1.	Apply design principles and guidelines to create visually appealing and user-friendly interfaces for websites and mobile applications.	2	-
2.	Develop wireframes and interactive prototypes using design tools to visualize and communicate interface concepts and user flows.	5	-
Course Contents:			
1. Designing a Login Form: Design a user-friendly login form for a mobile app. Consider the layout, input fields, button design, and error handling to create an intuitive and visually appealing login experience. 2. Creating a Navigation Menu: Design a navigation menu for a website that includes dropdown menus and a responsive design. Ensure the menu is easy to navigate and visually consistent across different screen sizes. 3. Redesigning a Landing Page: Redesign a landing page for a product or service. Improve the visual hierarchy, use compelling imagery, and optimize the layout to encourage user engagement and conversions. 4. Creating a Contact Form: Design a contact form for a website that captures essential user information. Consider input validation, error messages, and a confirmation message to enhance the user experience. 5. Designing a Product Card: Create a visually appealing product card for an e-commerce website. Include product images, title, price, and call-to-action buttons to entice users to learn more and make a purchase. 6. Improving Form Usability: Evaluate an existing form on a website for usability issues and propose improvements. Focus on optimizing the form's layout, labeling, and input validation to enhance user comprehension and completion rates. 7. Enhancing Mobile App Onboarding: Design an onboarding experience for a mobile app. Create a series of screens that introduce users to the app's features and guide them through the setup process in a clear and engaging manner. 8. Redesigning a Checkout Process: Redesign the checkout process for an e-commerce website. Simplify the steps, provide clear instructions, and optimize the layout and form inputs to streamline the purchasing experience. 9. Designing an Error Page: Design a visually appealing and helpful error page for a website. Consider the tone of the message, provide relevant information or suggestions, and include navigational elements to guide users back on track. 10. Creating an Interactive Prototype: Use a prototyping tool to create an interactive prototype for a mobile app or website. Design key screens and transitions to showcase the user flow and interactions within the interface.			

Course Title	FULL STACK DEVELOPMENT LABORATORY		
Course Code	21CS507C	L-T-P-C	(0-0-2)1
Exam Hrs.	3	Hours / Week	3
SEE	50 Marks	Total Hours	15
Course Objective: To gain a solid understanding of full-stack development fundamentals.			
Course Outcomes (COs): Upon completion of the course, students shall be able to:			
#	Course Outcomes	Mapping to POs	Mapping to PSOs
1.	Study and Implement WebPages using Basic and Advanced HTML.	2, 5	-
2.	Develop a complete web application from scratch that includes Front-end, Backend and Data-exchange technologies.	3, 5	-
Course Contents:			
1. HTML and CSS Webpage: Create a simple webpage that showcases your favorite hobby. Use HTML to structure the content and CSS to style the page, including adding colors, fonts, and images. 2. JavaScript Form Validation: Develop a web form with fields for name, email, and password. Implement JavaScript validation to ensure that all fields are filled correctly before submitting the form. 3. Node.js Server with Express: Build a basic server using Node.js and Express. Create routes to handle HTTP requests like GET and POST and respond with simple JSON data. 4. Database Integration: Extend the previous Node.js server by integrating a database (e.g., SQLite or MongoDB). Implement endpoints to perform CRUD operations on a dataset. 5. RESTful API: Design and implement a RESTful API using Node.js, Express, and a database of your choice. Define endpoints for managing resources, such as creating, reading, updating, and deleting data. 6. React Component Library: Create a library of reusable React components. Build components like buttons, cards, and modals and use them in a sample React application. 7. Full-Stack Task Manager: Develop a task manager application with React on the front end and Node.js/Express on the back end. Allow users to add, update, and delete tasks. 8. Authentication and Authorization: Add user authentication and authorization to the task manager application. Implement features like user registration, login, and protecting certain routes from unauthorized access. 9. Real-Time Chat Application: Build a real-time chat application using React for the front end and Node.js with Socket.IO for the back end. Enable users to send and receive messages in real-time.			

Course Title	VERSION CONTROLLER WITH GiT		
Course Code	21CS507D	L-T-P-C	(0-0-1)1
Exam Hrs.	3	Hours / Week	3
SEE	50 Marks	Total Hours	15
Course Objective: To use GitLab and Git and utilize it for software development.			
Course Outcomes (COs): Upon completion of the course, students shall be able to:			
#	Course Outcomes	Mapping to POs	Mapping to PSOs
1.	Understand the fundamental concepts of version control systems and their importance in software development	1	-
2.	Demonstrate proficiency in using basic Git commands for initializing repositories, tracking changes, and committing code	5	-
Course Contents:			
MODULE – 1			7 Hrs
1. Initializing a Repository: Initialize a new Git repository for a simple project. Add a few files to the repository and commit them. 2. Committing Changes: Make changes to the files in the repository and commit them. Practice creating meaningful commit messages 3. Creating and Switching Branches: Create a new branch in the repository, make changes in the branch, and switch between branches. 4. Merging Branches: Create a branch, make changes in both the main branch and the new branch, and merge the changes back into the main branch. 5. Resolving Merge Conflicts: Create a merge conflict by making conflicting changes in two different branches. Practice resolving the conflict using Git's conflict resolution tools. 6. Working with Remote Repositories: Clone a remote repository to your local machine. Make changes locally and push the changes back to the remote repository. 7. Collaborating with Others: Practice collaborating with others using Git. Clone a shared repository, make changes, push the changes, and pull changes made by others. 8. Reverting and Rolling Back Commits: Experiment with reverting commits and rolling back changes to a previous state in the repository using Git commands. 9. Tagging Releases: Tag a specific commit in the repository as a release version. Practice creating annotated tags and lightweight tags. 10. Ignoring Files: Create a .gitignore file to exclude certain files or directories from being tracked by Git. 11. Viewing Repository History: Use Git commands to view the commit history, explore differences between commits, and track changes made over time. 12. Branch Management: Practice creating, deleting, and renaming branches in the repository using Git commands.			

Course Title	ARTIFICIAL INTELLIGENCE		
Course Code	21CS551	L-T-P-C	(3-0-0)3
Exam Hrs.	3	Hours / Week	3
SEE	50 Marks	Total Hours	40
Course Objective: Students will be able to apply the concepts of Artificial Intelligence to construct knowledge-based.			
Course Outcomes (COs): Upon completion of the course, students shall be able to:			
#	Course Outcomes	Mapping to POs	Mapping to PSOs
1.	Describe different types of Artificial Intelligence agents, search strategies.	1	-
2.	Analyze different search strategies for a given problem.	2	-
3.	Design simple knowledge-based systems using first-order logic.	2	-
4.	Analyze different learning techniques.	3	-
Course Contents:			
MODULE – 1			10 Hrs
Introduction: What is AI? Intelligent Agents: Agents and environment; Good behavior: The Concept of Rationality; The nature of environment; The structure of agents. Problem-solving: Problem-solving agents. Example problems; Searching for solution; Uninformed search strategies: Breadth-first search, Uniform-cost search.			
MODULE – 2			10 Hrs
Uninformed search strategies: Depth-first search, Depth-limited search, Iterative deepening depth first search, Bidirectional search, Comparing uninformed search strategies; Informed (Heuristic) Search Strategies: Greedy best-first search, A* search, Optimality of A*, Memory-bounded heuristic search; Heuristic functions; Local Search Algorithms and Optimization Problems: Hill-climbing search, Simulated annealing, Local beam search, Genetic algorithms.			
MODULE – 3			10 Hrs
On-line search agents and unknown Environments: Online search problems, Online search agents, online local search, learning in online search, Logical Agents: Knowledge-based agents; The Wumpus world; First-Order Logic: Representation revisited; Syntax and semantics of first-order logic; Using first-order logic, Knowledge engineering in first-order logic.			
MODULE – 4			10 Hrs
Learning from Examples: Forms of Learning; supervised learning; Learning decision trees; Practical Machine Learning. Statistical and Reinforcement learning: Statistical learning, maximum likelihood parameter learning, Bayesian parameter, learning, passive reinforcement learning, active reinforcement learning.			
Text Book: 1. Artificial Intelligence - A Modern Approach, Stuart Russell and Peter Norvig, Third edition, Pearson, 2014.			
Reference Books: 1. Artificial Intelligence, Elaine Rich, Kevin Knight and Shivashankar B Nair, Third edition, McGraw-Hill Education, 2015. 2. Introduction to Artificial Intelligence and Expert Systems, Dan W Patterson, Pearson, 2015.			

Course Title	DATA MINING		
Course Code	21CS552	L-T-P-C	(3-0-0)3
Exam Hrs.	3	Hours / Week	3
SEE	50 Marks	Total Hours	40
Course Objective: To understand the concepts of data mining and to apply the same for a given application.			
Course Outcomes (COs): Upon completion of the course, students shall be able to:			
#	Course Outcomes	Mapping to POs	Mapping to PSOs
1.	Describe the design of Data Warehousing.	1, 2	-
2.	Compare and contrast different data mining tasks	2, 3,4	-
3.	Analyze data related issues for successful data mining.	1, 2	-
4.	Evaluate models/algorithms with respect to their accuracy.	1, 3,4	-
Course Contents:			
MODULE – 1			10 Hrs
Data Warehousing: Introduction, Operational Data Stores (ODS), Extraction Transformation Loading (ETL), Data Warehouses, Design issues, Guidelines for Data Warehouse Implementation, Data Warehouse metadata. Online Analytical Processing (OLAP): Introduction, Characteristics of OLAP systems, Multidimensional view and Data cube, Data cube implementations, Data cube operations, Implementation of OLAP.			
MODULE – 2			10 Hrs
Introduction to Data Mining: What is Data Mining? Motivating Challenges, The origins of data mining, Data Mining Tasks, Types of Data, Data Pre-processing, Measures of Similarity and Dissimilarity: Basics, Similarity and Dissimilarity between Simple Attributes, Dissimilarities between Data Objects, and Similarities between Data Objects.			
MODULE – 3			10 Hrs
Classification: Preliminaries; General approach to solving a classification problem; Decision tree induction; Rule-based classifier; Nearest-neighbor classifier, Association Analysis: Problem Definition; Frequent Item set generation; Rule Generation.			
MODULE – 4			10 Hrs
Association Analysis (cont...): FP-Growth algorithm, Evaluation of association patterns; Effect of skewed support distribution; Sequential patterns. Cluster Analysis: Overview, K-means, Agglomerative hierarchical clustering, DBSCAN.			
Text Books:			
1. Pang-Ning Tan, Michael Steinbach, Vipin Kumar, Introduction to Data Mining, 1st Edition (Reprint) Pearson Education, 2014.			
2. G. K. Gupta: Introduction to Data Mining with Case Studies, 3rd Edition, PHI, New Delhi, 2009.			
Reference Books:			
1. Jiawei Han and Micheline Kamber, Data Mining – Concepts and Techniques, Morgan Kaufmann, 3rd Edition, 2012.			
2. K.P. Soman, Shyam Diwakar, V.Ajay, Insight into Data Mining – Theory and Practice, PHI, 2006			
MOOCs:			
1. http://nptel.ac.in/courses/110106064/			
2. http://nptel.ac.in/courses/106106093/			
3. https://www.edx.org/course/analytics-for-decision-making			

Course Title	INTERNET OF THINGS		
Course Code	21CS553	L-T-P-C	(3-0-0)3
Exam Hrs.	3	Hours / Week	3
SEE	50 Marks	Total Hours	40
Course Objective: Explore the interconnection and integration of the physical world and design IOT applications.			
Course Outcomes (COs) : Upon the completion of the course the students will be able to			
#	Course Outcomes	Mapping to POs	Mapping to PSOs
1.	Analyze the impact and challenges posed by IoT networks and compare IoT architectures	1,2	-
2.	Identify smart objects, connectivity and IoT Access Technologies	1,2	-
3.	Appraise the role of IoT protocols for efficient network communication and Security in IoT network	2,3	-
4.	Adopt Raspberry Pi interface to develop IoT modules	2,3	2
5.	Employ security structures for IoT systems	1,3	-
Course Contents:			
MODULE - 1			10 Hrs
What is IoT, Genesis of IoT, IoT and Digitization, IoT Impact, Convergence of IT and IoT, IoT Challenges, IoT Network Architecture and Design, Drivers Behind New Network Architectures, Comparing IoT Architectures, A Simplified IoT Architecture, IoT Data Management and Compute Stack.			
MODULE – 2			10 Hrs
Smart Objects: The “Things” in IoT, Sensors, Actuators, and Smart Objects, Sensor Networks, Connecting Smart Objects: Communications Criteria, IoT Access Technologies.			
MODULE – 3			10 Hrs
IP as the IoT Network Layer: The Business Case for IP, The need for Optimization, Optimizing IP for IoT, Profiles and Compliances. Application Protocols for IoT: The Transport Layer, IoT Application Transport Methods.			
MODULE – 4			10 Hrs
IoT Physical Devices and Endpoints - RaspberryPi: Introduction to RaspberryPi, Exploring the RaspberryPi Board; Operating System setup on RaspberryPi, RaspberryPi commands, Programming RaspberryPi with Python. Securing IoT: A Brief History of OT Security, Common Challenges in OT Security, How IT and OT Security Practices and Systems Vary, Formal Risk Analysis Structures: OCTAVE and FAIR, The Phased Application of Security in an Operational Environment.			
Text Books:			
1. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Robert Barton, Jerome Henry, “IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things”, 1st Edition, Pearson Education (Cisco Press Indian Reprint). (ISBN: 978-9386873743)			
2. Srinivasa K G, Siddesh G M Hanumantha Raju R “Internet of Things”, CENGAGE Learning India, 2017.			

Reference Books:

1. Internet of Things - A Hands on Approach, Arshdeep Bahga and Vijay Madisetti Universities Press, 2015.
2. Olivier Hersent, David Boswarthick, Omar Elloumi, The Internet of Things: Key Applications and Protocols, 2nd Edition, Wiley ISBN: 978-1-119-99435-0, 370 pages, January 2012.

MOOCs:

1. <https://www.edx.org/course/introduction-to-the-internet-of-things-iot>
2. http://nptel.ac.in/noc/individual_course.php?id=noc17-cs22

OBJECT ORIENTED MODELING AND DESIGN				
Course Code	21CS554		L-T-P-C	(3-0-0)3
Exam Hours	3		Hours / Week	3
SEE	50 Marks		Total Hours	40
Course Objective :		Describe object oriented modeling concept and apply them to solve the problems.		
Course Outcomes (COs) :		Upon completion of the course, students shall be able to:		
COs	Statement		Mapping to POs	Mapping to PSOs
	Explore the basic concepts of object oriented modeling.		1,2	-
	Apply the object oriented concepts in modeling.		2,3	-
	Design the state diagrams and relationship between class and state models.		3	-
	Design use case models, sequence models and activity models.		3	-
	Select concepts of design pattern technologies.		2	-
Course Contents:				
Module 1			10 Hrs	
Introduction, Modeling Concepts, Class Modeling: What is Object Orientation? What is OO development? OO themes; Evidence for usefulness of OO development; Modeling as Design Technique: Modeling; abstraction; The three models. Class Modeling: Object and class concepts; Link and associations concepts Generalization and inheritance; A sample class model; Navigation of class models; Practical tips. Advanced Class Modeling, State Modeling: Advanced Class Modeling: Advanced object and class concepts; Association ends; N-ary associations; Aggregation; Abstract classes. Multiple inheritance; Metadata; Reification. Constraints; Derived data; Packages; Practical tips, State Modeling: Events, States, Transitions and Conditions; State diagrams; State diagram behavior; Practical tips.				
Module 2			10 Hrs	
Advanced State Modeling, Interaction Modeling: Advanced State Modeling: Nested state diagrams; Nested states; Signal generalization; Concurrency; A sample state model; Relation of class and state models; Practical tips, Interaction Modeling: Use case models; Sequence models; Activity models. Use case relationships.				
Interaction Modeling (contd.): Process Overview, System Conception: Procedural sequence models; Special constructs for activity models. Process Overview: Development stages; Development life cycle. System Conception: Devising a system concept; Elaborating a concept; preparing a problem statement.				
Module 3			10 Hrs	
Domain Analysis, Application Analysis, System Design: Domain Analysis: Overview of analysis; Domain class model; Domain state model; Domain interaction model; Iterating the analysis. Application Analysis: Application interaction model; Application class model; Application state model; Adding operations, Overview of system design; Estimating performance; Making a reuse plan; Breaking a system in to sub-systems; Identifying concurrency; Allocation of sub-systems.				
System Design (contd.), Class Design: Management of data storage; Handling global resources; Choosing a software control strategy; Handling boundary conditions; Setting the trade-off priorities; Common architectural styles; Architecture of the ATM system as the example, Class Design: Overview of class design; Bridging the gap; Realizing use cases; Designing algorithms. Recursing downwards, Refactoring; Design optimization; Reification of behavior; Adjustment of inheritance; organizing a class design; ATM example.				
Module 4			10 Hrs	
Class Design (contd.), Implementation Modeling, Legacy Systems:. Class Design45				

Implementation Modeling: Overview of implementation; Fine-tuning classes; Fine-tuning generalizations; Realizing associations; Testing. Legacy Systems: Reverse engineering; Building the class models; Building the interaction model; Building the state model; Reverse engineering tips; Wrapping; Maintenance.

Design Patterns: What is a pattern and what makes a pattern? Pattern categories; Relationships between patterns; Pattern description. Communication Patterns: Forwarder-Receiver; Client-Dispatcher-Server; Publisher-Subscriber, Management Patterns: Command processor; View handler. Idioms: Introduction.

Text Books

- | | |
|----|--|
| 1. | Michael Blaha, James Rumbaugh, Object- Oriented Modeling and Design with UML, Pearson Education, 2nd Edition, 2005. (Chapters 1 to 17, 23). |
| 2. | Frank Buschmann, Regine Meunier, Hans Rohnett, Peter Sommerlad, Michael Stal, Pattern-Oriented Software Architecture- A System of Patterns, Volume 1, John Wiley and Sons, 2006. (Chapters 1,3.5,3.6,4). |

Reference Books

- | | |
|----|---|
| 1. | Grady Booch et al, Object-Oriented Analysis and Design with Applications, Pearson, 3rd Edition, 2007. |
| 2. | Booch G. Runbaugh J, Jacobson. I, The Unified Modeling Language User Guide, Pearson, 2nd Edition, 2005. |

ADVANCED JAVA				
Course Code	22CS555		LTPC	(3-0-0)3
Exam. Hours	3		Hours / Week	03
SEE:	50 Marks		Total hours	40
Course Objective:		Students should be able to use J2EE concepts to create an application.		
Course Outcomes(COs):		Upon completion of the course, students shall be able to :		
COs	Statement			POs
1.	Interpret the need for advanced Java concepts like enumerations and collections in developing modular and efficient programs			PO1,PO2, PO3
2.	Design java programs that can build GUI and handle events.			PO1, PO3
3.	Develop distributed web application using Servlets and JSP by applying the concepts of JDBC to perform operations on Database			PO1,PO2,PO3
Course Contents:				
MODULE – 1				10 Hrs
Enumeration and Autoboxing: Enumeration fundamentals, values() and valuesOf() Methods, Java Enumerations are class types, example, Type Wrappers, Autoboxing and Autounboxing. Event Handling The delegation event model; Event classes; Sources of events; Event listener interfaces; Using the delegation event model; Adapter classes				
MODULE – 2				10 Hrs
User Interface components with Swing Components and containers, Layout managers, A first simple swing example, Event Handling, Creating a swing applet, Exploring Swing Controls-JLabel and ImageIcon, Jtextfield The Swing buttons, JTabbedPane, JScrollPane, JList, JCombobox.				
MODULE – 3				10 Hrs
The Collections Framework – Collections overview, The collection Interfaces, The collection classes, Accessing collection via an iterator. Database Access- The Concept of JDBC, JDBC Driver Types, JDBC Packages, A Brief Overview of the JDBC process, Database Connection, Statement Objects, Result Set				
MODULE – 4				10 Hrs
Servlets and JSP - Lifecycle of a sevelet, A simple servlet, The Servlet API, javax.servlet Package, Reading Servlet parameters, The javax.servlet.http Package, Handling HTTP Request and Responses, Using Cookies, Session tracking. Java Server Pages (JSP): JSP, JSP Tags, User Sessions, Cookies, Session Objects. RMI -. Java Remote Method Invocation: Remote Method Invocation concept; Server side, Client side.				
Text Books:				
1.	Herbert Schildt: Java The Complete Reference Eighth Edition, Mc Graw Hill, 2013.			
2.	Jim Keogh: J2EE The Complete Reference, Tata McGraw Hill, 2007.			
Reference Books:				
1.	Advanced Java Programming ,Uttam.K.Roy , Oxford Press,2015			
2.	Java Fundamentals Herbert Schildt Dale Skrien, Mc GrawHill 2013			
3.	"Head First Servlets and JSP" by Shroff,2nd Edition, O,Reilly Publications ,2008.			
MOOCs				
1.	http://www.nptelvideos.com/java/java_video_lectures_tutorials.php			
2.	https://www.youtube.com/watch?v=0KL_zftem4g/			
Course Title		OPERATIONS RESEARCH		

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Course Code	21CS556	L-T-P-C	(3-0-0)3
Exam Hrs.	3	Hours / Week	3
SEE	50 Marks	Total Hours	40
Course Objective: Solve optimization problems using various methods			
Course Outcomes (COs): Upon completion of the course, students shall be able to:			
#	Course Outcomes	Mapping to POs	Mapping to PSOs
1.	Develop mathematical model for a given problem.	1	-
2.	Apply techniques of Operations Research.	2	-
3.	Solve prediction and estimation problems.	1, 2	-
4.	Expose to the significance of various scientific tools.	5	-
Course Contents:			
MODULE – 1			10 Hrs
Introduction: Introduction: The origin, nature and impact of OR; Overview of the Operations Research Modeling Approach: Defining the Problem and Gathering Data; Formulating a Mathematical Model; Deriving Solutions from the Model; Testing the Model; Preparing to Apply the Model; Implementation Linear Programming – 1: Prototype example; The Linear Programming (LP) Model, Assumptions of LP, Additional Examples			
MODULE – 2			10 Hrs
Simplex Method - 1: The Essence of the Simplex Method; Setting up the Simplex Method; The Algebra of the Simplex Method; The Simplex Method in Tabular Form; Tie Breaking in the Simplex Method Simplex Method – 2: Adapting to other Model Forms; Post Optimality Analysis, Computer implementation			
MODULE – 3			10 Hrs
Revised Simplex Methods: Foundations of the Simplex Method, The revised simplex method, A Fundamental Insight Duality Theory: The Essence of Duality Theory; Economic Interpretation of Duality. Primal-Dual Relationships , Adapting to other primal forms, The role of duality in sensitive analysis; The essence of sensitivity analysis; Applying sensitivity analysis, The dual simplex method ; Parametric linear programming; The upper bound technique.			
MODULE – 4			10 Hrs
Transportation Model: Definition of the Transportation Model, Nontraditional Transportation Models, The Transportation Algorithm. Assignment Model and Network Models : The Assignment Model, CPM and PERT			
Text Books: 1. Frederick S. Hillier and Gerald J. Lieberman, “Introduction to Operations Research”, Tata McGrawHill, 9th Edition, 2012. (Chapters: 1.1 to 1.3, 2, 3.1 to 3.3, 4.1 to 4.7, 5, 6.1 to 6.7, 7.1) 2. Hamdy A Taha, “Operations Research: An Introduction”, Prentice Hall India, 8th Edition, 2005.(Chapters: 5, 6.4)			
Reference Book: 1. Wayne L. Winston, “Operations Research Applications and Algorithms”, Thomson Course Technology, 4th Edition 2003			

Course Code	21CS601	L-T-P-C	(3-0-0) 3
Exam Hrs.	3	Hours / Week	4
SEE	50 Marks	Total Hours	50
Course Objective: To apply the techniques of machine learning for real time projects. Course Outcomes (COs): Upon completion of the course, students shall be able to:			
#	Course Outcomes	Mapping to POs	Mapping to PSOs
1.	Develop a good understanding of fundamental principles of machine learning	1,2,3	-
2.	Formulation of a Machine Learning problem	1,2,4	-
3.	Develop a model using supervised/unsupervised machine learning algorithms for classification/prediction/clustering	2,3,4	-
4.	Evaluate the performance of various machine learning algorithms on various data sets of a domain.	4,5	-
MODULE - 1			10 Hrs
Introduction: What Is Machine Learning? Examples of Machine Learning Applications, Learning Associations, Classification, Regression, Unsupervised Learning. Learning Problems and Concept Learning: Well Posed learning problems, Designing a Learning systems, Concept Learning Tasks, Search, Find-S, Version Spaces and Candidate Elimination Algorithm. Self Study: Reinforcement Learning.			
MODULE – 2			10 Hrs
Dimensionality Reduction: Introduction, Subset Selection, Principal Component Analysis, Singular Value Decomposition and Matrix Factorization. Supervised Learning: Decision Tree learning, Representation, Algorithm, Issues in decision tree learning. Self Study : Linear Discriminant Analysis.			
MODULE - 3			10 Hrs
Supervised Learning: Support Vector Machine, K-Nearest Neighbor Learning, Locally Weighted Regression, Radial Basis Functions. Artificial Neural Networks: Neural Network Representation, Problems for Neural Network learning, Perceptron's, Multilayer Networks and Back Propagation Algorithms. Self Study : Adaline Madaline.			
MODULE – 4			10 Hrs
Unsupervised Learning: Introduction, Hierarchical Clustering, k-Means Clustering. Bayesian learning: Introduction, Bayes theorem, Bayes theorem and concept learning, Naïve Bayes classifier, Bayesian belief networks, EM algorithm. Self Learning: Problems on Hierarchical Clustering.			
Text Books: 1. Tom M. Mitchell, Machine Learning, McGraw-Hill Education (INDIAN EDITION), 2013. 2. Ethem Alpaydin, Introduction to Machine Learning, 2nd Ed., PHI Learning Pvt. Ltd., 2013 Reference Books: 1. Saikat Dutt, Subramanian Chandramouli, Amit Kumar Das, Machine Learning, Pearson, 2019 2. T. Hastie, R. Tibshirani, J. H. Friedman, The Elements of Statistical Learning, Springer; 1st edition, 2001 3. Bishop, C. ,M., Pattern Recognition and Machine Learning, Springer, 2006 4. Yegnanarayana B. Artificial Neural Netwroks PHI Learning Pvt., Ltd.			

Course Title	WEB PROGRAMMING		
Course Code	21CS602	L-T-P-C	(2-0-1)3
Exam Hrs.	3	Hours / Week	4
SEE	50 Marks	Total Hours	50
Course Objective: Create web pages with client side and server-side scripting			
Course Outcomes (COs): Upon completion of the course, students shall be able to :			
#	Course Outcomes	Mapping to POs	Mapping to PSOs
1.	Apply the knowledge of HTML/XHTML and CSS in designing webpage.	1	2
2.	Develop client-side script to design webpage	3	2
3.	Design server-side script to create webpage	3,5	2
4.	Create web pages using JavaScript, xml, PHP and MySQL for the real world applications.	1,3,5	2
Course Contents:			
MODULE – 1			10 Hrs
Fundamentals of Web, XHTML: Internet, WWW, Web Browsers, and Web Servers; URLs; MIME; HTTP; the Web Programmers Toolbox. XHTML: Basic syntax; Standard structure; basic text markup; Images; Hypertext Links; Lists; Tables; Forms.			
MODULE – 2			10 Hrs
CSS: Introduction; Levels of style sheets; Selector forms; Property value forms; Font properties. List properties; Color; Alignment of text; The box model; Background images; Theand<div>tags. JavaScript: Overview of JavaScript; Syntactic characteristics; Primitives, operations, and expressions; Screen output and keyboard input; Control statements; Object creation, and modification; Arrays; Functions; Pattern matching using regular expressions.			
MODULE – 3			10 Hrs
JavaScript and HTML Documents: The JavaScript execution environment; Element access in JavaScript; Events and event handling; Handling events from the Body elements, Button elements, Text box and Password elements; The navigator object. Dynamic Documents with JavaScript: Introduction to dynamic documents; Element positioning; Moving elements; Element visibility; Changing colors and fonts; Dynamic content; Stacking elements; Locating the mouse cursor.			
MODULE – 4			10 Hrs
XML: Introduction; Syntax; Document structure; Namespaces, XML schemas, Displaying raw XML documents; Displaying XML documents with CSS; XSLT style sheets. PHP: Origins and uses of PHP; Overview of PHP; General syntactic characteristics; Primitives, operations and expressions; Output; Control statements; Arrays; Functions; Pattern matching; Form handling; Cookies; Session tracking; Database Access using PHP and MySQL.			
Text Book:			
1. Robert W. Sebesta: Programming the World Wide Web, 8th Edition, Pearson Education, 2014.			
Reference Books:			
1. Deitel H.M. and Deitel P.J., “Internet and World Wide Web How to program”, Pearson International, 2012, 4th Edition.			
2. Randy Connolly, Ricardo Hoar, “Fundamentals of Web Development”, Pearson, 2015.			
3. ISRD Group: Internet Technology and Web Design, Tata McGraw Hill Publishing Ltd, 2011			
MOOCs:			
1. https://www.mooc-list.com/course/programming-and-web-beginners-coursera			

2. <http://nptel.ac.in/courses/117105080/3>
3. <https://www.coursera.org/specializations/web-design>
4. <http://www.w3c.org>

Activity:

Web programs are to be developed.

Course Title	COMPUTER NETWORKS		
Course Code	21CS603	L-T-P-C	(3-0-0)3
Exam Hrs.	3	Hours / Week	3
SEE	50 Marks	Total Hours	40
Course Objective: Students able to acquire knowledge of working mechanisms of different types of Networks, Address Mechanisms and Protocols.			
Course Outcomes (COs): Upon completion of the course, students shall be able to:			
#	Course Outcomes	Mapping to POs	Mappin gto PSOs
1.	Recognize the importance of the Network Layer Services and Network addressing mechanisms	1,12	-
2.	Identify and formulate the different Versions of Internet Protocols and IP Addresses	2	-
3.	Analyse and investigate the performance of Uncast and Multicast routing algorithms and their uses	2,4	-
4.	Design and apply the Transport Layer Protocols for different new services	4,5	-
5.	Apply and Investigate the use of different QoS models and their applications	1, 4	-
MODULE-1			10 Hrs
Network Layer: Network Layer Services, IPv4 Addresses: Address Space, Classful Addressing, Classless Addressing, DHCP, NAT; Network Layer Protocols: Internetwork Protocol: Datagram format, Fragmentation, Options, Security of IPV4 Datagrams; ICMPv4: Messages, Mobile IP: Addressing, Agents, Three Phases, Inefficiency in Mobile IP;			
MODULE-2			10 Hrs
Unicast Routing: Introduction: General Idea, Least Cost Routing; Routing Algorithms: Distance Vector, Link-State Routing, Path-Vector Routing; Unicast Routing Protocols: Internet Structure, Routing Information Protocol (RIP), Open Shortest Path First (OSPF), Border Gateway Protocol Version 4 (BGP4); Multicast Routing: Introduction: Unicasting, Multicasting, Broadcasting; MULTICASTING BASICS: Multicast Addresses, Delivery at Data-Link Layer, Collecting Information about Groups, Multicast Forwarding, Two Approaches to Multicasting;			
MODULE-3			10 Hrs
INTRADOMAIN MULTICAST PROTOCOLS: Multicast Distance Vector (DVMRP), Multicast Link State (MOSPF) Protocol Independent Multicast (PIM); INTERDOMAIN MULTICAST PROTOCOLS: IGMP: Messages, Propagation of Membership Information, Encapsulation; Next Generation IP: IPV6 Addressing, The IPV6 Protocol; Transport Layer protocols: Introduction: Services, Port Numbers, User Datagram Protocol(UDP): User Datagram, UDP Services, UDP Applications;			
MODULE-4			10 Hrs
Transmission Control Protocol: TCP Services, TCP Features, Segment, A TCP Connection, Windows in TCP; Flow Control, Error Control, TCP Congestion Control; TCP Timer and Options; Stream Control Transmission Protocol (SCTP): Services, Features, Packet Format and Association; Quality of Services: Data Flow Characteristics; Flow Control to Improve QoS: Scheduling, Traffic Shaping or Policing, Resource Reservation, Admission Control; INTEGRATED SERVICES (INTSERV): Flow Specification, Admission, Service Classes, Resource Reservation Protocol (RSVP); DIFFERENTIATED SERVICES (DFFSERV).			
Text Book: 1. Behrouz A. Forouzan, Data Communications and Networking, Tata McGraw-Hill, 5th Edition (Chapters 14,15.3,16,17,18.1,18.4,19,20,21,22.1,22.2,24,30)			

Reference Books:

1. Alberto Leon-Garcia and Indra Widjaja, “Communication Networks–Fundamental Concepts and Key architectures”, Tata McGraw- Hill, 2nd Edition.
2. William Stallings, “Data and Computer Communication”, Pearson Education, 8th Edition.
3. Nader F. Mir, Computer and Communication Networks, Pearson Education, 2014.

MOOCs:

1. <http://nptel.ac.in/courses/106105081/>
2. <https://www.edx.org/course/computer-networks-internet-kironx-fhlcnx>

Course Title	APPLICATION DEVELOPMENT LABORATORY		
Course Code	21CS604	L-T-P-C	(0-0-1)1
Exam Hrs.	3	Hours / Week	2
SEE	50 Marks	Total Hours	28
Course Objective: Design and develop apps for android devices.			
Course Outcomes (COs): Upon completion of the course, students shall be able to:			
#	Course Outcomes	Mapping to POs	Mapping to PSOs
1.	Develop simple applications, using built-in widgets and components of android studio.	5,9	1
2.	Document the apps designed.	10	-
Course Contents:			
1. Develop an android application which accepts the SGPA of all the six semesters and displays your CGPA. 2. Develop an android application to login into a system which is redirected to the Home screen. The login should be successful on email: admin@example.com password: rtWi2p_10 If the email/password is invalid display a Toast with an error message 3. Assume you are accepting employee details: Name, Designation, Salary, Phone number. Develop app that displays an alert message if phone number entered is more than 10 digits. 4. Design an app that displays the names of all planets in our universe. Clicking on “Solar System” in first activity should display all the planet’s names in second activity and it should return the total number of planets to first activity. 5. Develop a QUIZ app that displays a question with four answers as options. Clicking an option should display whether the selected option is right or wrong. 6. Assume you need to accept order online for fast food items. Design an app such that it accepts the order for multiple items and displays the total amount to be paid on placing the order. 7. Design an app to display menu options on clicking a button “FILE”. The menu options are: New, Open, Save, Save as, And Print. Clicking on any option should display the relevant information. 8. Design an app to accept your name, roll number and branch programmatically. 9. Develop an android application to list all the engineering branches of MCE and displays a brief information of any department which the user clicks on in a separate page. 10. Consider a scenario where you need to send an email to multiple users. Design an app to implement the same. 11. Develop an android application to display a gallery view (Grid View) of at least 10 images. 12. Develop an android application to render the text data into Text View from the remote server. Show progress bar when the data is loading or Toast message if data fails to load.			

Course Title	MACHINE LEARNING LABORATORY		
Course Code	21CS605	L-T-P-C	(0-0-1)1
Exam Hrs.	3	Hours/Week	2
SEE	50 Marks	Total Hours	28
Course Objective: Provide fundamental elements of Machine Learning algorithms and its applications. Course Outcomes(COs): Upon the completion of the course the students will be able to:			
#	Course Outcomes	Mapping to POs	Mapping to PSOs
1.	Design and implement Machine Learning concepts and algorithms	2,3,4,5	1
2.	Implement and document Machine Learning programs	10	-
Course Contents:			
Practice Programs			
1. Write a program to compute distance between two points taking input from the user. (Pythagorean Theorem) 2. Write a program that takes two numbers as command line arguments and prints its sum. 3. Write a Program for checking whether the given number is an even number or not. 4. Using a for loop, write a program that prints out the decimal equivalents of 1/2, 1/3, 1/4,..., 1/10. 5. Write a program to count the numbers of characters in the string and store them in a dictionary data structure. 6. Write a program to count frequency of characters in a given file. Use character frequency to tell whether the given file is a Python program file, C program file or a text file? 7. Find mean, median and mode for the given set of numbers in a list. 8. Write function to compute GCD, LCM of two numbers. 9. Write a program that defines a matrix and prints the same.			
Exercise Programs			
1. Implement and demonstrate the FIND-S algorithm for finding the most specific hypothesis based on a given set of training data samples. Read the training data from a .CSV file. 2. For a given set of training data examples stored in a .CSV file, implement and demonstrate the Candidate-Elimination algorithm to output a description of the set of all hypotheses consistent with the training examples. 3. Write a program to demonstrate the working of the decision tree based ID3 algorithm . Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample. 4. Build an Artificial Neural Network by implementing the Back propagation algorithm and test the same using appropriate data sets. 5. Write a program to implement the naïve Bayesian classifier for a sample training data set stored as a . CSV file. Compute the accuracy of the classifier, considering few test data sets. 6. Assuming a set of documents that need to be classified, use the naïve Bayesian Classifier model to perform this task. Built-in API can be used to write the program. Calculate the accuracy, precision, and recall for your data set. 7. Write a program to construct a Bayesian network considering medical data. Use this model to demonstrate the diagnosis of heart/ lung patients using standard disease Data Set. 8. Apply EM algorithm to cluster a set of data stored in a .CSV file. Use the same data set for clustering using k-Means algorithm . Compare the results of these two algorithms and comment on the quality of clustering. 9. Write a program to implement k-Nearest Neighbour algorithm to classify the iris data set. Print both correct and wrong predictions 10. Implement the non-parametric Locally Weighted Regression algorithm in order to fit data points. Select appropriate data set for your experiment and draw graphs.			

Activity:

1. Write a program to demonstrate the working of PCA.
2. Write a program to demonstrate the working of the SVD.
3. Write a program to demonstrate the working of the LDA.
4. Write a program to demonstrate the working of the SVM. Use an appropriate data set for building the SVM and apply this knowledge to classify a new sample.
5. Write a program to demonstrate the working of the Hierarchical Clustering. Use an appropriate data set for building the Hierarchical Clustering and apply this knowledge to cluster a new sample.

MINI PROJECT (Inter-Discipline)			
Course Code	21CS606	L-T-P-C	(0-0-1)2
Exam Hrs.	3	Hours / Week	4
SEE	50 Marks	Total Hours	28
Course Objective : Identify, analyze and formulate problem statement for project work with systematic and comprehensive approach Course Outcomes (COs): Upon completion of course the students will be able to:			
#	Course Outcomes	Mapping to POs	Mapping to PSOs
1.	Take a real-world problem, plan, and document the same	1,2,3,10	
2.	Design and conduct experiments and test against requirements and specifications.	1,3,4	1,2
3.	To present and communicate technical material through project demonstration and report.	1,5,10	
4.	Demonstrate the ability to work effectively as a project member.	1,9	
- A team of TWO students must develop the mini project. However, during the final evaluation, each student must demonstrate the project individually. - The team may implement a mini project of their choice. - The team must submit a Brief Project Report (25 to 30 Pages) at the end which must include the following - Introduction - Requirements - Development Process and Models Adopted - Analysis and Design Models - Implementation - Testing - The project report will be evaluated for 25 marks, Demonstration for 50 marks and Viva Voce for 25 marks.			

Rubrics for Evaluation of Mini Project (Inter-Discipline)					
Phase I (Project Proposal Submission and Evaluation Scheme):					
After finalizing the topic with the guidance of Supervisor, students should submit the project proposal along with Synopsis not exceeding 10 pages. Approval of synopsis is done for 15 marks by concerned project committee.					
Sl. No	Performance Indicators	Needs Improvement (0-1 mark)	Average (2-3 marks)	Good (4-5 marks)	Max marks
1	Literature Survey	Survey of literature is not recent or no literature survey	Survey of literature is not clear	Literature survey is sufficient.	5
2	Synopsis writing	Objective of the work is not identified.	Objective of the work is identified but no evidence of Inter disciplinary approach found.	Objective of the work is identified with evidence of Inter disciplinary approach found.	5
3	Presentation	Contents delivered not completely.	Contents not delivered clearly.	Contents delivered clearly with confidence.	5
Total					15

Phase II (Project Progress):					
Evaluation of project phase II is carried out by evaluation committee.					
Sl. No.	Performance Indicators	Needs Improvement (0-1 marks)	Average (2-3 marks)	Good (4-5 marks)	Max marks
1.	System design and development	System specification is not identified.	System specification is identified but not satisfactory.	System specification is identified correctly.	5
2.	Identification of appropriate tool for application	Application tools are not identified.	Application tools identified but not used.	Application tools identified and used.	5
3.	Oral presentation	Entire contents not delivered.	Contents not delivered clearly.	Contents delivered clearly with confidence.	5
Total					15
Phase III (Project Demonstration with Report):					
Evaluation of this phase is done by evaluation committee.					
Sl. No.	Performance Indicators	Needs Improvement (0-1 marks)	Average (2-3 marks)	Good (4-5 marks)	Total marks allocated
1.	Design and Implementation	Not done.	Incomplete.	Complete.	5
2.	Demonstration	Incomplete.	Complete but not satisfactory.	Complete and satisfactory	5
3.	Documentation	Organization and clarity of report and technical content is not clear and complete.	Organization and clarity of report and technical content is clear but not complete.	Organization and clarity of report and technical content is clear and complete.	5
4.	Oral presentation	Presentation with ppt is not clear.	Presentation with ppt is clear but not satisfactory.	Presentation with ppt is clear and satisfactory.	5
Total					20

Semester End Evaluation				
Evaluation committee consists of panel of examiners containing external as well as internal evaluators. This evaluation is carried out for 50 marks.				
Sl. No.	Performance Indicators		Marks allocated	Marks awarded
1.	Project execution	Project specification	5	
		Progress	5	
2.	Methodology /Result Analysis	System Design	5	
		System Implementation	5	
		System Testing	5	
3.	Project Report	Organization and Clarity	5	
		Technical content	5	
		Conclusion and Future work	5	
Final presentation			10	
Total Marks			50	
Rubrics for Semester End Exam				
Marks	Overall criteria			
48-50	Project is reaching professional standards.			
40-47	Project is excellent and may contain publishable material. Presentation is excellent.			
35-39	Project and presentation are very good. All design aims are met.			
30-34	Project and presentation are good. Most design aims are met.			
25-29	Minimum core of design aims has been met. Presentation is satisfactory.			
20-24	Design aims and implementation are met partially. Presentation is moderate.			
0-20	Most design aims are not met and implementation does not work. Presentation is not satisfactory.			

PATTERN RECOGNITION			
Course Code	: 21CS661		L-T-P-C : (3-0-0)3
Exam Hours	: 3		Hours / Week : 3
SEE	: 50 Marks		Total Hours : 40
Course Objective :	Apply pattern recognition techniques to real world problems.		
Course Outcomes (COs) :	Upon completion of the course, students shall be able to:		
COs	Statement	POs	
1.	Choose appropriate pattern recognition algorithm for an application.	PO1, PO2	
2.	Choose an appropriate procedure for a particular application.	PO2	
3.	Analyze the methods and types of clustering.	PO3	
4.	Analyze and come out with results using proper technical terminology.	PO4	
5.	Solve real world problems on pattern recognition.	PO1,PO2	
Course Contents:			
Module 1			
Introduction: Machine perception, an example; Pattern Recognition System; The Design Cycle; Learning and Adaptation.			
			5 Hrs
Bayesian Decision Theory: Introduction, Bayesian Decision Theory; Continuous Features, Minimum error rate, classification, classifiers, discriminate functions, and decision surfaces; The normal density; Discriminant functions for the normal density.			
			5 Hrs
Module 2			
Maximum-likelihood and Bayesian Parameter Estimation: Introduction; Maximum-likelihood estimation; Bayesian Estimation; Bayesian parameter estimation: Gaussian Case, general theory; Hidden Markov Models.			
			5 Hrs
Non-parametric Techniques: Introduction; Density Estimation; Parzen windows; kn – Nearest-Neighbor Estimation; The Nearest- Neighbor Rule; Metrics and Nearest-Neighbor Classification.			
			5 Hrs
Module 3			
Linear Discriminant Functions: Introduction; Linear Discriminant Functions and Decision Surfaces; Generalized Linear Discriminant Functions; The Two-Category Linearly Separable case; Minimizing the Perception Criterion Functions; Relaxation Procedures; Non-separable Behavior; Minimum Squared-Error procedures; The Ho-Kashyap procedures.			
			5 Hrs
Stochastic Methods: Introduction; Stochastic Search; Boltzmann Learning; Boltzmann Networks and Graphical Models; Evolutionary Methods.			
			5 Hrs
Module 4			
Non-Metric Methods: Introduction; Decision Trees; CART; Other Tree Methods; Recognition with Strings; Grammatical Methods.			
			5 Hrs

Unsupervised Learning and Clustering: Introduction; Mixture Densities and Identifiability; Maximum-Likelihood Estimates; Application to Normal Mixtures; Unsupervised Bayesian Learning; Data Description and Clustering; Criterion Functions for Clustering.	
	5 Hrs
Text Books:	
	Richard O. Duda, Peter E. Hart, and David G. Stork, Pattern Classification, Wiley-Interscience, 2nd Edition, 2012.
Reference Books:	
	Earl Gose, Richard Johnsonbaugh, Steve Jost, Pattern Recognition and Image Analysis, Pearson Education, 2007.

Course Title	DIGITAL IMAGE PROCESSING		
Course Code	21CS662	L-T-P-C	(3-0-0)3
Exam Hrs.	3	Hours / Week	3
SEE	50 Marks	Total Hours	40
Course Objective : To study the image fundamentals and mathematical transforms necessary for image processing along with image enhancement, restoration, compression and segmentation techniques Course Outcomes (COs) : Upon the completion of the course the students will be able to:			
#	Course Outcomes	Mapping to POs	Mapping to PSOs
1.	Explain the basic principles of Digital image processing	1,2	-
2.	Elucidate mathematical modeling of filtering and image restoration	2,3,5	-
3.	Apply concepts of Digital image processing using coloring model	2,3,4,5	-
4.	Analyze image processing algorithms	2,9,10,11	1
5.	Develop image processing application for real time problems	5,9,11	2
Course Contents:			
MODULE – 1			10 Hrs
Introduction: Basic concepts, Examples of fields that use Digital Image Processing, Fundamental steps in Digital Image Processing, Components of an Image Processing System. Digital Image Fundamentals: Elements of visual perception. Image sensing and acquisition: Image sampling and quantization: Basic concepts in sampling and quantization, Representing digital images, Spatial and Intensity resolutions, some basic relationships between pixels: An Introduction to the Mathematical tools used in digital image processing.			
MODULE – 2			10 Hrs
Intensity Transformations and Spatial Filtering: Background: The basics of intensity transformations and spatial filtering, Some basic intensity transformation functions, Histogram Processing. Fundamentals of spatial filtering: The mechanics of spatial filtering, Spatial correlation and convolution. Image Restoration: A model of the image restoration/degradation process. Noise Models: Spatial and Frequency properties of Noise.			
MODULE – 3			10 Hrs
Image Restoration: Some important noise probability density functions, Periodic noise, Estimation of noise parameters, Restoration in the presence of Noise only- Spatial Filtering, Mean Filters. Color Image Processing: Color fundamentals, Color models: The RGB color model. Image Compression: Fundamentals: Coding redundancy, Spatial and Temporal redundancy, Irrelevant information, Measuring image information, Fidelity Criteria.			
MODULE – 4			10 Hrs
Image Compression: Some basic compression methods: Arithmetic coding, LZW coding, Bit_Plane coding, Digital image watermarking. Image Segmentation : Fundamentals, Point, Line, and Edge Detection, Background, Detection of Isolated Points, Line Detection, Edge Models, Basic Edge Detection: The Image Gradient and its Properties, Gradient Operators, Combining the Gradient with Thresholding, Thresholding: Foundation, The Basics of Intensity Thresholding, The Role of Noise in Image Thresholding, The Role of Illumination and Reflectance in Image Thresholding.			
Text Book: 1. Rafael C. Gonzales, Richard E. Woods, “Digital Image Processing”, 4th Edition, Pearson publications, 2018			

Reference Books:

1. A.K. Jain, “Fundamentals of Digital Image Processing”, Pearson 2nd Edition, 2018.
2. B. Chanda , Dutta Majumdeer, “Digital Image Processing and Analysis”, Prentice-Hall of India Pvt.Ltd., 2nd Edition, 2011.
3. “Introduction to Digital Image Processing with Matlab”, Rafael C. Gonzales, Richard E. Woods, Steven L.Eddins, McGraw Higher Ed, 2nd Edition, 2010.

MOOC:

1. <http://nptel.ac.in/courses/106105032>

Course Title	WIRELESS NETWORKS		
Course Code	21CS663	L-T-P-C	(3-0-0)3
Exam Hrs.	3	Hours/Week	3
SEE	50 Marks	Total Hours	40
Course Objective: Students able to gain knowledge of various terminology, principles, devices, schemes, concepts, algorithms and different methodologies used in Wireless Communication Networks.			
Course Outcomes(COs): Upon completion of the course, students shall be able to:			
#	Course Outcomes	Mapping to POs	Mapping to PSOs
1.	Explore fundamentals of wireless communications.	1,2	-
2.	Analyse security, energy efficiency, mobility, scalability, and their unique characteristics in wireless networks.	2,3	-
3.	Demonstrate basic skills for cellular networks design.	1,2	-
4.	Apply knowledge of TCP/IP extensions for mobile and wireless networking.	2,3	1
Course Contents:			
MODULE – 1			10 Hrs
Introduction: Wired Network vs. Wireless Network, Overview of Wireless Applications, Wireless Transmission: Path loss, Multi-path propagation, Doppler shift, Fading, Time Division Multiplexing, Frequency Division Multiplexing, Code, Spread Spectrum Technique, Satellite Communication;			
MODULE – 2			10 Hrs
CELLULAR SYSTEM: Cellular Network Organization, Cellular System Evolution, Cellular Fundamentals: Capacity, Topology, Operation of Cellular Systems, Handoff, Power control, Case study: Global System for Mobile communication (GSM) Network, General Packet Radio Service (GPRS), Code Division Multiple Access (CDMA 2000), Cordless System, Wireless Local Loop, Mobility Management-Location Management, HLR-VLR scheme, Hierarchical scheme, Predictive location management schemes;			
MODULE – 3			10 Hrs
WIRELESS NETWORK: Protocols: Media Access Protocol, Mobile IP, Mobile Transport Layer Protocol, Wireless Access Protocol, Ad-Hoc Networks and Routing, Standards: IEEE 802.11, Wi-Fi, Wireless Broadband-Wi-MAX, Bluetooth, IEEE 802.15, Security in Wireless Network, Hyper LAN.			
MODULE – 4			10 Hrs
MOBILE COMPUTING: Mobile Computing, Issues: Resource Management, Interference, Bandwidth, Cell Splitting, Frequency reuse, Mobile Data Transaction Models, File Systems, Mobility Management, Security.			
Text Books :			
1. William Stallings, "Wireless Communications & Networks", 2/E, Pearson Education India, Reprint 2007. 2. Jochen Schiller, "Mobile Communications", 2/E, Pearson Education India, reprint 2007			
Reference Book:			
1. Sandeep Singhal, "The Wireless Application Protocol" , Addison Wesley, India, reprint 2001 2. T S Rappaport, "Wireless Communications: Principles & Practice", 2/E, Pearson Education, 2002. 3. C E Perkins, "Ad Hoc Networking", Addison Wesley, 2000.			
MOOCs:			
1. https://onlinecourses.nptel.ac.in/noc20_ee61/preview			

Course Title	SOFTWARE ARCHITECTURE		
Course Code	21CS664	L-T-P-C	(3-0-0)3
Exam Hrs.	3	Hours / Week	3
SEE	50 Marks	Total Hours	40
Course Objective: Provide students with the principles and concepts of applying various design patterns in designing a wide variety of software system. Course Outcomes (COs) : Upon the completion of the course the students will be able to :			
#	Course Outcomes	Mapping to POs	Mapping to PSOs
1.	Explore the significance of software architecture.	1,2	-
2.	Apply quality attributes to create an architecture for the given application.	2,3	-
3.	Analyze the architectural pattern and build the system from components.	2,3	-
4.	Create documentation relevant to the chosen architecture.	1,10	-
Course Contents:			
MODULE – 1			10 Hrs
What Is Software Architecture? : What Software Architecture Is and What It Isn't; Architectural Structures and Views; Architectural Patterns; What Makes a “Good” Architecture? Why Is Software Architecture Important? Inhibiting or Enabling a System's Quality Attributes; Reasoning About and Managing Change ; Predicting System Qualities; Enhancing Communication among Stakeholders; Carrying Early Design Decisions ; Defining Constraints on an Implementation; Influencing the Organizational Structure ; Enabling Evolutionary Prototyping Improving Cost and Schedule Estimates ; Supplying a Transferable, Reusable Model; Allowing Incorporation of Independently Developed Components; Restricting the Vocabulary of Design Alternatives; Providing a Basis for Training; The Many Contexts of Software Architecture: Architecture in a Technical Context, Architecture in a Project Life-Cycle Context, Architecture in a Business Context, Architecture in a Professional Context, Stakeholders, How Is Architecture Influenced?, What Do Architectures Influence?, Quality Attributes Understanding Quality Attributes; Architecture and Requirements ; Functionality; Quality Attribute ; Considerations ; Specifying Quality Attribute; Requirements ; Achieving Quality Attributes through Tactics, Guiding Quality Design Decisions.			
MODULE – 2			10 Hrs
Availability: Availability General Scenario; Tactics for Availability; Modifiability: Modifiability General Scenario; Tactics for Modifiability Performance: Performance General Scenario; Tactics for Performance; Security: Security General Scenario; Tactics for Security ; Architectural Patterns – 1: Introduction; from mud to structure: Layers, Pipes and Filters.			
MODULE – 3			10 Hrs
Architectural Patterns – 2: Distributed Systems: Broker; Interactive Systems. Architectural Patterns – 3: Presentation-Abstraction-Control; Adaptable Systems: Microkernel;			
MODULE – 4			10 Hrs

Some Design Patterns: Structural decomposition: Whole – Part; Organization of work: Master – Slave; Access Control: Proxy. Designing and Documenting Software Architectures: Design Strategy; The Attribute-Driven Design Method; The Steps of ADD; Uses and Audiences for Architecture; Documentation; Notations for Architecture; Documentation; Views; Choosing the Views; Combining Views; Building the Documentation Package; Documenting Behavior; Architecture Documentation and Quality Attributes; Documenting Architectures That Change Faster Than You Can Document Them.
Text Books: 1. Len Bass, Paul Clements, Rick Kazman: Software Architecture in Practice, 3rd Edition, Addison-Wesley, 2013. 2. Frank Buschmann, Regine Meunier, Hans Rohnert, Peter Sommerlad, Michael Stal: Pattern-Oriented Software Architecture, A System of Patterns, Volume 1, John Wiley and Sons, 2009.
Reference Books: 1. Mary Shaw and David Garlan: Software Architecture- Perspectives on an Emerging Discipline, PHI, 2008. 2. E. Gamma, R. Helm, R. Johnson, J. Vlissides: Design Patterns- Elements of Reusable Object-Oriented Software, Addison-Wesley, 1995.
MOOCs: 1. http://www.hillside.net/patterns 2. http://www.nptel.ac.in/syllabus/106104027 3. https://www.mooc-list.com/course/software-architecture-coursera

Course Title	C# PROGRAMMING AND .NET		
Course Code	21CS665	L-T-P-C	(3-0-0)3
Exam Hrs.	3	Hours/Week	3
SEE	50 Marks	Total Hours	40
Course Objective: Students will be able to develop various console and windows applications.			
Course Outcomes(COs): Upon completion of the course, students shall be able to:			
#	Course Outcomes	Mapping to POs	Mapping to PSOs
1.	Develop programs that use reusability properties and namespaces.	3	-
2.	Design applications using classes, methods, interfaces and inheritance techniques and manage exceptions.	1, 3	-
3.	Create delegates, packages and manage database.	2, 3	-
4.	Demonstrate windows application system and build their own applications	3	1
Course Contents:			
MODULE – 1			10 Hrs
Overview of C#: Introduction , A Simple C# Program, Namespaces , Adding Comments, Main Returning a Value, Using Aliases for Namespace Classes, Passing String Objects to WriteLine Method, Command Line Arguments, Main with a Class, Providing Interactive Input, Using Mathematical Functions, Multiple Main Methods, Compile Time Errors. Literals, Variables and Data Types: Introduction, Literals , Variables , Data Types , Value Types Reference Types, Declaration of Variables , Initialization of Variables , Default Values ,Constant Variables , Scope of Variables , Boxing and Unboxing. Operators and Expressions : Introduction, Arithmetic Operators, Relational Operators, Logical Operators, Assignment Operators, Increment and Decrement Operators, Conditional Operator, Bitwise Operators , Special Operators ,Arithmetic Expressions, Evaluation of Expressions ,Precedence of Arithmetic Operators, Type Conversions ,Operator Precedence and Associatively. Mathematical Functions. Decision Making and Branching: Introduction, Decision Making with if Statement, Simple if Statement, The if... else Statement, Nesting of if... else Statements, The else if Ladder, The Switch Statement The? : Operator. Decision Making and Looping: Introduction, The while Statement The do Statement, The for Statement, The foreach Statement. Methods in C#: Introduction, Declaring Methods, The Main Method, Invoking Methods, Nesting of Methods, Method Parameters, Pass by Value, Pass by Reference, The Output Parameters, Variable Argument Lists, Methods Overloading. Handling Arrays: One-Dimensional Arrays, Creating an Array, Two- Dimensional Arrays, Variable- Size Arrays, the System. Array Class. Manipulating Strings : Creating Strings, String Methods, Inserting Strings, Comparing Strings, Finding Substrings, Mutable Strings, Arrays of Strings			
MODULE – 2			10 Hrs
Classes and Objects : Introduction, Basic principles of OOP, Defining a Class, Adding Variables and Methods, Member Access Modifiers, Creating Objects, Accessing Class members, Constructors, Overloaded Constructors, Static Members, Static Constructors, Private Constructors, Copy Constructors, Destructors, Member Initialization. Inheritance and Polymorphism: Introduction, Classical Inheritance, Containment Inheritance, Defining a Subclass, Visibility Control, Defining Subclass Constructors, Multilevel Inheritance, Hierarchical Inheritance, Overriding Methods, Hiding Methods, Abstract Classes, Abstract Methods, Sealed Classes: Preventing Inheritance, Sealed Methods, The this reference, Nesting of Classes, Constant Members, Read-only Members, Properties, Indexers. Polymorphism, Interface: Multiple Inheritance, Multiple Inheritance: Introduction, Defining an Interface, Extending an Interface, Implementing Interfaces, Interfaces and Inheritance, Explicit Interface Implementation, Abstract Class and Interfaces.			

Operator Overloading: Introduction, Over loadable Operators, Need for Operator Overloading, Overloading Unary Operators, Overloading Binary Operators, Overloading Comparison Operators Delegates and Events: Introduction, Delegates, Delegate Declaration, Delegate Methods, Delegate Instantiation, Delegate Invocation, Using Delegates, Multicast Delegates, Events. Managing Errors and Exceptions: Introduction, What is Debugging? Types of Errors, Exceptions, Syntax of Exception Handling Code, Multiple Catch statements, The Exception Hierarchy, General Catch Handler, Using Finally statement, Nested Try Blocks, Throwing our Own Exceptions, Checked and Unchecked Operators, Using Exceptions for Debugging.	
MODULE – 3	10 Hrs
Understanding. NET: The C# Environment: Building a Better Window (Introducing Windows Forms): Overview of the System. Windows. Forms Namespace, Working with the Windows Forms Types, The Role of the Application Class ,The Anatomy of a Form, The Functionality of the Control Class, The Functionality of the Form Class, Building Windows Applications with Visual Studio 2005, Working with MenuStrips and ContextMenuStrips, Working with StatusStrips. Programming with Windows Forms Controls: The World of Windows Forms Controls, Adding Controls to Forms by and, Adding Controls to Forms Using Visual Studio 2005, Working with the Basic Controls, Configuring the Tab Order, Setting the Form's Default Input Button, Working with More Exotic Controls, Building Custom Windows Forms Controls, Testing the CarControl Type, Building a Custom CarControl Form Host.	
MODULE – 4	10 Hrs
Data Access with ADO.NET: A High-Level Definition of ADO.NET, Understanding, DO.NET Data Providers, Additional ADO.NET Namespaces, The System. Data Types, Abstracting Data Providers Using Interfaces, Increasing Flexibility Using Application ,Configuration Files, The .NET 2.0 Provider Factory Model, The <connectionStrings> Element Installing the Cars Database, Understanding the Connected Layer of ADO.NET, Working with Data Readers, Modifying Tables Using Command Objects, Working with Parameterized Command Objects, Executing a Stored Procedure Using DbCommand, Asynchronous Data Access Under .NET 2.0, Understanding the Disconnected Layer of ADO.NET. ASP. NET Web Pages and Web Controls: The Role of HTTP, Understanding Web Applications and Web Servers, The Role of HTML, The Role of Client-Side Scripting, Submitting the Form Data (GET and POST), Building a Classic ASP Page, Problems with Classic ASP, The ASP.NET 2.0 Namespaces, The ASP.NET Web Page Code Model, Details of an ASP.NET Website Directory Structure, The ASP.NET 2.0 Page Compilation Cycle, The Inheritance Chain of the Page Type, Interacting with the Incoming HTTP Request, Interacting with the Outgoing HTTP Response, The Life Cycle of an ASP.NET Web Page, Understanding the Nature of Web Controls	
Text Books : 3. Andrew Troelsen , “Pro C# and the .NET 3, Special edition, A Press, 2012 4. E. Balagurusamy," Programming in C# A Primer", 3rd edition, TMH, 2010.	
Reference Book: 1. Tom Archer: Inside C#, WP Publishers, 2001.	
MOOCs: 2. https://www.udemy.com/course/c-net-for-beginners/ 3. https://www.udemy.com/course/aspnet-webforms/	

Course Title	MANAGEMENT INFORMATION SYSTEMS		
Course Code	21CS666	L-T-P-C	(3-0-0)3
Exam Hrs.	3	Hours / Week	3
SEE	50 Marks	Total Hours	40
Course Objective: To describe the role of information technology and decision support systems in business and record the current issues with those of the firm to solve business problems.. Course Outcomes (COs) : Upon completion of the course, students shall be able to:			
#	Course Outcomes	Mapping to POs	
1.	Relate the basic concepts and technologies used in the field of management information systems	9, 11	
2.	Compare the processes of developing and implementing information systems	6, 7	
3.	Outline the role of the ethical, social, and security issues of information systems	1, 4	
4.	Apply the understanding of how various information systems like DBMS work together to accomplish the information objectives of an organization.	1,11	
	Course Contents:		
MODULE – 1			10 Hrs
The meaning and use MIS, System View of Business, Process of MIS, Development of MIS within the organization, Management Process, Information Needs, System Approach in Planning Organizing and Controlling MIS.			
MODULE – 2			10 Hrs
System analysis and design: System - Need for system analysis - System analysis of the existing system - System analysis of a new requirements - System Development Model - Structured System Analysis and Design - Object Oriented Analysis.			
MODULE – 3			10 Hrs
MIS applications, DSS – GDSS - DSS applications in E enterprise - Knowledge Management System and Knowledge Based Expert System - Enterprise Model System and E-Business, E- Commerce, E-communication, Business Process Reengineering.			
MODULE – 4			10 Hrs
Technology of information system: Data process- Transaction and application process Information system process; Unified communication and network; Security challenges in E-enterprises; Security threats and vulnerability-Controlling security threat and vulnerability			
Text Books: 1. Jawadekar, W.S., “Management Information Systems”, Tata McGraw Hill Private Limited, New Delhi, 2009. 2. Kenneth C. Laudon and Jane P. Laudon: “Management Information Systems” 9/e, Pearson Education, New Delhi. Rference Books 1. Goyal, D.P.: “Management Information System”, MACMILLAN India Limited, New Delhi, 2008. 2. Mahadeo Jaiswal, Monika Mital: “Management Information System”, Oxford University Press, New Delhi.			

Course Title	INTRODUCTION TO CLOUD COMPUTING		
Course Code	21OECS61	L-T-P-C	(3-0-0)3
Exam Hrs.	3	Hours / Week	3
SEE	50 Marks	Total Hours	40
Course Objective: Students will be able to find out cloud computing service models and applications.			
Course Outcomes (COs): Upon completion of the course, students shall be able to:			
#	Course Outcomes	Mapping to POs	Mapping to PSOs
1.	Apply the knowledge for the identification of architecture and infrastructure for Cloud Computing.	2, 4	-
2.	Assessment of the economics, financial, and technological implications for selecting cloud deployment model	2, 4	-
3.	Choose appropriate cloud model for a given application	3, 5	-
4.	Identify security management in cloud	6, 8	-
5.	Develop applications for cloud computing	5, 7	-
Course Contents:			
MODULE – 1			10 Hrs
Introduction: Cloud computing at a glance, historical developments, building cloud computing environments, computing platforms and technologies. Principles of parallel and Distributed computing: Eras of computing, parallel vs. Distributed computing, elements of parallel computing, elements of distributed computing, technologies for distributed computing.			
MODULE – 2			10 Hrs
Virtualization: Introduction, characteristics of virtualized environments, Taxonomy of virtualization techniques, virtualization and cloud computing, pros and cons of virtualization technology. Cloud Computing architecture: Introduction, Cloud reference model, types of clouds, economics of the cloud, open challenges.			
MODULE – 3			10 Hrs
Cloud platforms in industry: Amazon Web Services, Google AppEngine, Microsoft Azure. Advanced topics in cloud computing: Energy efficiency in clouds, Market based management of clouds, federated clouds/inter clouds, Third party cloud services.			
MODULE – 4			10 Hrs
Infrastructure security, IAM: Infrastructure security: network level, host level, application level, Identity and Access management: trust boundaries and IAM, why IAM? IAM challenges, IAM definitions, IAM architecture and practices, getting ready for cloud, IAM standards and protocols for cloud services, IAM practices in the cloud authorization management. Security management in the cloud: security management standards, security management in the cloud, availability management, SaaS, PaaS. IaaS availability management, access control, security vulnerability, patch and configuration management. Privacy: What is privacy? What is data life cycle? What are the key privacy concerns in cloud? Who is responsible for protecting privacy?			
Text Books:			
1. Mastering Cloud Computing, McGraw Hill publication, Rajkumar Buyya, Christian Vecchiola, S.ThamaraiSelvi			
2. Cloud security and privacy an enterprise perspective on risks and compliances, 2013, Tin Mather, Subra kumarswamy, shahed Latif			
Reference Books:			
1. Cloud Computing: Theory and Practice, Dan C Marinescu, first edition, MK publishers Nalin K Sharad, Multimedia information Networking, PHI, 2012.			
2. Cloud Computing- A practical approach, McGraw Hill publication, Anthony T. Velte, Toby J. Velte, Robert Elsenpeter			

MOOCs:

1. <https://www.youtube.com/watch?v=Eg4AAGCE7X4>
2. <https://www.coursera.org/learn/cloud-computing>
3. <https://www.edx.org/course/introduction-cloud-computing-microsoft-cloud200x>

Activity:

Students are required to demonstrate the usage of various cloud deployment models.

Course Title	INTRODUCTION TO JAVA PROGRAMMING		
Course Code	21OEC62	L-T-P-C	(3-0-0)3
Exam Hrs.	3	Hours / Week	3
SEE	50 Marks	Total Hours	40
Course Objective:			
Course Outcomes (COs): Upon completion of the course, students shall be able to:			
#	Course Outcomes	Mapping to POs	Mapping to PSOs
1.	Summarize the strengths and weaknesses of Java programming and the basic concepts of object-oriented programming.	PO1,PO2	-
2.	Develop reusable programs using the concepts of inheritance, polymorphism, interfaces and packages	PO1, PO2, PO3	-
3.	Apply the concepts of String Handling and Exception handling to develop efficient and error free codes.	PO1, PO2, PO3	-
Course Contents:			
MODULE – 1			10 Hrs
Basic concepts of Java : The History and Evolution of java: OOP Concepts, History of java, The java Buzz words, The Evolution of java, Lexical issues. Data types, variables: Data types, Variables, The Scope and Life time of variables, Operators, Expressions, Control statements, Type conversion and casting, Command Line Arguments.			
MODULE – 2			10 Hrs
Arrays: Declaration, Initialization and accessing values, One-Dimensional Arrays, Multi-dimensional arrays, Alternative Array Declaration Syntax, var-arg methods. Strings: Explore String class, StringBuffer and StringBuilder classes.			
MODULE – 3			10 Hrs
Class fundamentals. Declaration objects, Assigning object reference variables, Introducing Methods, Constructors, “this” keyword, Garbage collection. Inheritance basics, Using Super keyword, Types of inheritance, Benefits, Member access rules, Constructor and calling sequence, Using abstract Classes, Using final keyword. Method overriding and overloading.			
MODULE – 4			10 Hrs
Defining an interface, Implementing interface, Accessing interface properties. Defining Package, finding packages and class path, accessing Protection. Exception handling Fundamentals, exception types, Built-in Exceptions, Using try-catch-finally throw- throws Keywords, creating your own Exception subclasses.			
Text Books:			
1. Herbert Schildt, “Java The complete reference”, 9 th edition, McGraw Hill Education(India) Pvt. Ltd. 2. Ivor Horton, Beginning Java 2, JDK 5th Edition, Wiley dreamtech.			
Reference Books:			
1. An introduction to java programming and object oriented application development, R AJohson-Thomson. 2. Introduction to Java programming-comprehensive, Y. Daniel Liang, Tenth Edition, Pearson ltd 2015. 3. E Balagurusamy, Programming With Java : A Primer 5th Edition Tata McGraw Hill.			

Course Title	ANALYTICAL ABILITY AND SOFT SKILLS		
Course Code	21ASK	L-T-P	(0-1-0)1
Exam	1	Hours/Week	40
SEE	50 Marks	Total Hours	80
This course will be conducted at the end of fifth semester for two weeks by TAP department.			
Course Objective: To Enhance problem solving skills and communication skills			
Course outcomes: At the end of course, student will be able to:			
#	Course Outcomes	Mapping to PO's	Mapping to PSO's
1.	Apply methods to solve numerical and reasoning problems	2,3	-
2	Lead a team in corporate offices	8,9	-
3	Communicate effectively in professional ambience	10	-
MODULE – 1			
Hard Skills: Speed/Distance, Probability, Permutations/Combinations, Profit/Loss, Simple Interest/Compound Interest, Number theories, Number/Letter series, Coding/Decoding, Blood relations, Directions, Clock, Calendar. Logical reasoning problems			
MODULE – 2			
Soft Skills: Basic grammar, Spotting errors, Sentence formation, Email writing, Public speaking, Client communication, Leadership, Managerial skills, Stress management, Presentation Skills			
MODULE -3			
Technical Skills: Review of C programming, Simple coding, Syntax rules, MCQs on C language.			
MODULE -4			
Activities: GD, JAM, Mock Interview, Pick and speak, Presentation			

Course Title	CONSTITUTION OF INDIA AND PROFESSIONAL ETHICS		
Course Code	21CIP	L-T-P-C	(0-1(A)-0)0
Exam Hrs.	3	Hours / Week	2
SEE	50 Marks	Total Hours	28
Course Contents:			
Preamble to the constitution of India - Evolution of constitutional Law Scope and extent of fundamental rights under part III - Details of Exercise of rights, Limitations and Important Cases.			
			4 Hrs
Relevance of Directive Principles of State Policy under Part IV, Significance of Fundamental Duties under Part IV a.			
			4 Hrs
Union Executive President, Vice-President, Prime Minister, Council of Ministers, Parliament and Supreme Court of India.			
			3 Hrs
State Executive, Governor, Chief Minister, Council of Ministers, Legislature and High Courts.			
			4 Hrs
Constitutional provisions for scheduled castes and tribes, women and children and backward classes, Emergency provisions.			
			4 Hrs
Electoral process, amendment procedure, 42 nd , 44 th , 74 th , 76 th , 86 th and 91 st constitutional amendments.			
			3 Hrs
Honesty, integrity and reliability, risks, safety and liability in engineering.			
			3 Hrs
Professional Ethics: Scope and aims of engineering ethics, responsibility of engineers, impediments to responsibility.			
			3 Hrs
Text Books:			
1. Durga Das Basu : Introduction to the Constitution of India (Students Edn.), PH -EEE, 19 th / 20 th Edition., 2001 2. Charles E Haries, Michael S Pritchard and Michael J Robins, Engineering Ethics, Thompson Asia, 2003-08-05			
Reference Books:			
1. M V Pylee : An Introduction to Constitution of India, Vikas Publishing 2. M Govindarajan, S Natarajan, V S Senthilkumar : Engineering Ethics, Prentice - Hall of India, New Delhi, 2004			

Course Title	SYSTEM SOFTWARE AND COMPILER DESIGN		
Course Code	21CS701	L-T-P-C	(3-1-0) 3
Exam Hrs.	3	Hours / Week	4
SEE	50 Marks	Total Hours	40L+10T
Course Objective:	To get acquainted with the features of system software and the various phases of compiler design.		
Course Outcomes (COs):	Upon the completion of the course the students will be able to:		
#	Course Outcomes	Mapping to POs	Mapping to PSOs
1.	Describe the concepts of system software and the features of various machine architectures.	1	-
2.	Demonstrate the functions and features of an assembler used to generate the object program.	2,3	-
3.	Apply the concepts of Loaders, Linkers and Macro Processors for a given problem	2,3	-
4.	Apply Lexical and Syntactic analysis for a given grammar.	3,4,5	-
Course Contents:			
MODULE – 1			10 Hrs
Machine Architecture, Assembler 1: The Simplified Instructional Computer (SIC) Assemblers: Basic assembler functions, Machine dependent assembler features. Assembler 2: Machine Independent Assembler Features, Assembler Design Options.			
MODULE – 2			10 Hrs
Loaders and Linkers: Basic Loader Functions, Machine-Dependent Loader Features, Machine-Independent Loader Features, Loader Design Options. Macro Processor: Basic Macro Processor Functions, Machine-Independent Macro Processor Features.			
MODULE – 3			10 Hrs
Introduction: Language Processors, The structure of a Compiler, Applications of Compiler Technology, Programming Language Basics. Lexical Analysis: Role of Lexical Analyzer, Input buffering, Specifications of tokens, Recognition of Tokens.			
MODULE – 4			10 Hrs
Syntax Analysis: Introduction, Context –free Grammar and Structure of Language, Parser and its Types, Top- Down parser-Recursive descent parsing and Non-Recursive descent parsing, Predicting parsing table, Error recovering strategies.			
Tutorial a) Write and execute a LEX program to count the number of characters, words, spaces & no. of lines in a given input file. b) Write a LEX program to count the number of comment lines in a given C program. Also eliminate them and copy that program into separate file. - Write a LEX program to recognize a valid arithmetic expression and to recognize the identifiers and operators present and to print them separately. a) Write a LEX program to recognize and count the number of identifiers in a given input file. b) Write a LEX program to find & replace String. a) Write a LEX program to check the validity of a Date. b) Write LEX program by reading input file and copy the content with line number to another file. - Write YACC program to recognize a valid arithmetic expression that uses operators +, -, * & /.			

Course Title	CLOUD COMPUTING		
Course Code	21CS702	L-T-P-C	(3-0-0)3
Exam Hrs.	3	Hours / Week	3
SEE	50 Marks	Total Hours	40
Course Objective: To expose students to frontier areas of cloud computing service models and applications.			
Course Outcomes (COs): Upon completion of the course, students shall be able to:			
#	Course Outcomes	Mapping to POs	Mapping to PSOs
1.	Explain concepts of cloud computing	1	-
2.	Recognize the different virtualization techniques, architecture and types of clouds	2	-
3.	Determine the cloud platforms and adopt Cloud Computing services and tools in real life scenarios.	2,7	-
4.	Integrate new standards for access management, security and privacy at different levels of cloud services	6,8	-
5.	Develop and deploy an application for cloud platform	5,9,10,12	1,2
Course Contents:			
MODULE – 1			10 Hrs
Introduction: Cloud computing at a glance, historical developments, building cloud computing environments, computing platforms and technologies. Principles of parallel and Distributed computing: Eras of computing, parallel vs. Distributed computing, elements of parallel computing, elements of distributed computing, technologies for distributed computing.			
MODULE – 2			10 Hrs
Virtualization: Introduction, characteristics of virtualized environments, Taxonomy of virtualization techniques, virtualization and cloud computing, pros and cons of virtualization technology. Cloud Computing architecture: Introduction, Cloud reference model, types of clouds, economics of the cloud, open challenges.			
MODULE – 3			10 Hrs
Cloud platforms in industry: Amazon Web Services, Google AppEngine, Microsoft Azure. Advanced topics in cloud computing: Energy efficiency in clouds, Market based management of clouds, Federated clouds/Inter clouds, Third party cloud services.			
MODULE – 4			10 Hrs
Infrastructure security, IAM: Infrastructure security: network level, host level, application level, Identity and Access management: trust boundaries and IAM, why IAM? IAM challenges, IAM definitions, IAM architecture and practices, getting ready for cloud, IAM standards and protocols for cloud services, IAM practices in the cloud, cloud authorization management; Security management in the cloud: security management standards, security management in the cloud, availability management, SaaS, PaaS. IaaS availability management, access control, security vulnerability, patch and configuration management. Privacy: What is privacy?, what is data life cycle?, what are the key privacy concerns in cloud?, who is responsible for protecting privacy?			
Text Books:			
1. Mastering Cloud Computing, McGraw Hill publication, Rajkumar Buyya, Christian Vecchiola, S. Thamarai Selvi			
2. Cloud security and privacy an enterprise perspective on risks and compliances, 2013, Tin Mather, Subra Kumar Swamy, Shahed Latif			

Reference Books:

1. Cloud Computing: Theory and Practice, Dan C Marinescue, first edition, MK publishers.
2. Cloud Computing- A practical approach, McGraw Hill publication, Anthony T. Velte, Toby J. Velte, Robert Elsenpeter.

MOOCs:

1. <https://www.youtube.com/watch?v=Eg4AAGCE7X4>
2. <https://www.coursera.org/learn/cloud-computing>
3. <https://www.edx.org/course/introduction-cloud-computing-microsoft-cloud200x>

Course Articulation matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3		-	-	-	-	-	-	-	-	-	-	-	-
CO2	-	3	-	-	-	-	-	-	-	-	-	-	-	-
CO3	-	3	-	-	-		2	-	-	-	-	-	-	-
CO4	-	-	-	-	-	2	-	2	-	-	-	-	-	-
CO5	-	-	-	-	3	-	-	-	3	2	-	2	3	2

Course Title	NETWORK SECURITY AND CYBER LAW		
Course Code	21CS703	L-T-P-C	(3-0-0) 3
Exam Hrs.	3	Hours / Week	3
SEE	50 Marks	Total Hours	40
Course Objective:	Apply cryptography techniques on malicious networks and cyber law, IPR, IT Act.		
Course Outcomes (COs):	Upon the completion of the course the students will be able to:		
#	Course Outcomes	Mapping to POs	Mapping to PSOs
1.	Explore the various types of Security attacks and Ciphers	1,12	-
2.	Encrypt/Decrypt the message by applying Traditional and Modern Block Ciphers.	3	-
3.	Apply Symmetric and Asymmetric key Cryptography Algorithms for a given problem.	3	-
4.	Describe the strategies and regulations of Cyber law and IT act	6,8	2
Course Contents:			
MODULE – 1			10 Hrs
Introduction: Security goals, Cryptographic attacks, Services and Mechanisms, Techniques for security goals implementation, Mathematics of cryptography: Integer Arithmetic, The Extended Euclidean Algorithm; Traditional Symmetric-Key Ciphers: Symmetric-Key Ciphers, Categories of traditional ciphers. Self-Study Component (Not included in SEE):: Modular Arithmetic, Matrices and Linear Congruence			
MODULE – 2			10Hrs
Stream and Block ciphers; Introduction to Modern Symmetric-Key Ciphers: Modern block ciphers, Components of modern block ciphers, Two classes of Product Ciphers, Attacks designed for block ciphers.; Data Encryption Standard: History and Data Encryption Standard, DES Structure, DES Analysis, Security of DES, Multiple DES-Conventional Encryption Algorithm. Self-Study Component (Not included in SEE): Mathematics of Symmetric-Key cryptography: Field and GF(2n) Fields.			
MODULE – 3			10 Hrs
The CAST Block Cipher, Data Encryption Standard Blowfish, IDEA; Advanced Encryption Algorithm: History and Advanced Encryption Algorithm, Transformation used by AES; Asymmetric Key cryptography: Difference between symmetric cryptography and asymmetric Key cryptography Cryptosystem, RSA cryptosystem, Rabin Cryptosystem ; Self-Study Component (Not included in SEE): Mathematics of Asymmetric-Key cryptography: Primes, Primality testing, Factorization, Chinese Remainder Theorem.			
MODULE – 4			10 Hrs
Security and Cyber Law: INTRODUCTION: Cyberspace , Cyber security, Cyber security Policy , Cyber Crime, Nature of Threat , Enabling People, Mission and Vision of Cyber security Program , OBJECTIVES : Emerging Trends of Cyber Law , Create Awareness , Areas of Development , International Network on Cyber security; Intellectual Property Rights: Types of Intellectual Property Rights, Advantages of Intellectual Property Rights, Intellectual Property Rights in India, Intellectual Property in Cyber Space; The information Technology Act - IT act aim and objectives, Scope of the act, Major Concepts, Important provisions, Attribution, acknowledgement, and dispatch of electronic records, Secure electronic records and secure digital signatures, Regulation of certifying authorities: Digital Signature certificates, Duties of Subscribers, Penalties and adjudication.			

Text Books:

1. Behrouz A Forouzan, Debdeep Mukhopadhyay, “Cryptography and Network Security” Third edition published by McGraw Hill Education-2017.
2. Cryptography, Network Security and Cyber Laws – Bernard Menezes, Cengage Learning, 2010 edition

Reference Books:

1. Hans Delfs, Helmut Knebl, “Introduction to Cryptography: Principles and Applications”, Springer
2. Neal Koblitz, “Number theory and cryptography”, Springer, 2007.
3. William Stallings: Cryptography and Network Security, Fifth Edition, Pearson Education-2013

MOOCs:

1. <http://nptel.ac.in/courses/106105031/>
2. <https://www.edx.org/learn/cybersecurit>
3. https://www.tutorialspoint.com/information_security_cyber_law/index.htm

Course Articulation matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-		-	-	-	-	-	-	-	-	2	-	-
CO2	-	-	3	-	-	-	-	-	-	-	-	-	-	-
CO3	-	-	3	-	-	-	-	-	-	-	-	-	-	-
CO4	-	-	-	-	-	2		3	-	-	-	-	-	2

Course Title	MAIN PROJECT PHASE - I		
Course Code	21CS704	L-T-P-C	(0-0-4)2
Exam Hrs.	3	Hours / Week	4
SEE	50 Marks	Total Hours	-
Course Objective:	To be able to identify a relevant problem that requires technical solution and conduct survey for the same.		
Course Outcomes (COs):	Upon the completion of the course the students will be able to:		
#	Course Outcomes	Mapping to POs	Mapping to PSOs
1.	Identify a problem, through Extensive literature Survey leading to publication of a survey paper.	1,2	
2.	Plan & design the solution to the chosen problem	3	2
3.	Make oral presentation and documentation of the work carried out	9,10	
Course Contents:			
During VII semester, candidates in consultation with the guides shall carry out literature survey to finalize the topic of the project. <i>The same project will be continued in Eighth semester.</i> Students are expected to present the project synopsis, system analysis, requirements specification and should publish a technical paper on Literature Survey. The evaluation will be carried out in three stages • Project Stage 1 – Team Formation , Topic Selection & Guide allotment (No marks) • Project Stage 2 – Extensive Literature Survey , Problem Definition • Project Stage 3 – Preliminary Design, Report Preparation and Publication The evaluation of the project phases shall be carried out by the evaluation committee comprising of project guide & other faculty members. The committee will be constituted by the project coordinator in consultation with the Head of the department. <i>For Multidisciplinary projects guides will be allotted from each concerned branch.</i>			
Performance Indicators	Low (40%)	Medium(70%)	High(100%)
Literature Survey and Problem Definition (20 Marks)	Literature Survey not pertaining to the title of the project (8)	Incomplete literature survey and improper problem definition (14)	Extensive literature survey with clear state of the art problem definition (20)
Preliminary Design (10 Marks)	Has no coherent strategies for problem Solving (4)	Has some strategies for problem – solving, but does not apply them consistently (7)	Formulates strategies for solving problems (10)
Presentation (10 marks)	Disorganized and ineffective presentation (4)	Organized, but ineffective presentation (7)	Effective organized presentation (10)
Report Preparation (30 Marks)	Disorganized and contents are not sufficient	Organized but not good content wise	Effectively organized and well framed contents
Paper Publication (20 Marks)	Paper submitted & awaiting results (8)	National conference International Conference (14)	Journal (20)
Punctuality (Project Dairy Maintenance) (10 marks)	Not meeting the guide regularly (4)	Meeting regularly but doesn't document details of every session (7)	Up to date dairy maintenance(10)

Course Articulation matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	-	-	-	-	-	-	-	-	-	2	-	-
CO2	-	-	3	-	-	-	-	-	-	-	-	-	-	3
CO3	-	-	-	-	-	-	-	-	3	3	-	-	-	-

Course Title	DEEP LEARNING		
Course Code	21CS771	L-T-P	(3-0-0)3
Exam	3 Hrs.	Hours/Week	3
SEE	50 Marks	Total Hours	40
Course Objective:	Introduce major deep learning algorithms and their applications to solve real world problems.		
Course Outcomes (COs):	At the end of the course, student will be able to:		
#	Course Outcomes	Mapping to POs	Mapping to PSOs
1.	Describe the fundamentals of deep learning algorithms	1	1
2.	Apply suitable deep learning algorithms for the given problem.	3	2
3.	Use tensor-flow and keras for training the models.	3, 5	2
4.	Solve problems using Deep Neural networks, CNN and RNN.	3, 4, 5, 9, 10	1, 2
Course Contents :			
MODULE-1			10 Hrs
Introduction to Artificial Neural Networks with Keras- From Biological to Artificial Neurons, Biological Neurons, Logical Computations with Neurons, Architectures of Neural Network, Learning Process in ANN, The Perceptron, MultiLayer Perceptron (MLP) and Backpropagation, Types of Activation Functions, Regression MLPs, Classification MLPs. Implementing MLP's with Keras, : Installing TensorFlow 2, Building an Image Classifier Using the Sequential API, Building a Regression MLP Using the Sequential API, Building Complex Models Using the Functional API, Saving and Restoring a Model, Using Callbacks, Visualization Using TensorBoard, Fine-Tuning Neural Network Hyperparameters			
MODULE-2			10 Hrs
Training Deep Neural Networks- Vanishing/Exploding Gradients, Glorot and He Initialization, Nonsaturating Activation Functions, Batch Normalization, Gradient Clipping, Reusing Pretrained Layers, Transfer Learning With Keras, Unsupervised Pretraining, Pretraining on an Auxiliary Task. Faster Optimizers, Momentum Optimization, Nesterov Accelerated Gradient, AdaGrad, RMSProp, Adam and Nadam Optimization, Learning Rate Scheduling. Avoiding Overfitting Through Regularization, ℓ_1 and ℓ_2 Regularization, Dropout, Monte-Carlo (MC) Dropout, Max-Norm Regularization.			
MODULE-3			10 Hrs
Loading and Preprocessing Data with TensorFlow – The Data API, Chaining Transformations, Shuffling the Data, Preprocessing the Data, Putting Everything Together, Prefetching, Using the Dataset With tf.keras. The TF Record Format , Compressed TFRecord Files, A Brief Introduction to Protocol Buffers, TensorFlow Protobufs, Loading and Parsing Examples, Handling Lists of Lists Using the Sequence Example Protobuf. The Features API, TF Transform, The TensorFlow Datasets (TFDS) Project. Deep Computer Vision Using Convolutional Neural Networks - Architecture of Visual Cortex, Convolutional Layer, Filters, Stacking Multiple Feature Maps, TensorFlow Implementation, Memory Requirements, Pooling Layer, TensorFlow Implementation.			
MODULE-4			10 Hrs

Deep Computer Vision Using Convolutional Neural Networks : CNN Architectures, LeNet-5, AlexNet, GoogLeNet, VGGNet, ResNet, Xception, SEnet, Implementing a ResNet-34 CNN Using Keras, Using Pretrained Models From Keras, Pretrained Models for Transfer Learning, Classification and Localization, Object Detection: Fully Convolutional Networks (FCNs), You Only Look Once (YOLO), Semantic Segmentation

Processing Sequences Using RNNs and CNNs - Recurrent Neurons and Layers , Training RNNs, Forecasting a Time Series, Baseline Metrics , Implementing a Simple RNN.

Text Book:

“Hands-On Machine Learning with Scikit-Learn, Keras and Tensor Flow: Concepts, Tools and Techniques to Build Intelligent Systems – September 2019: Second Edition” by Aurelien Geron.

Reference Book:

“Python Machine Learning- Third Edition” by Sebastian Raschka and Vahid Mirjalili

e-Book:

<https://www.oreilly.com/library/view/hands-on-machine-learning/9781492032632/>

MOOCs:

1. <https://www.edx.org/course/deep-learning-with-tensorflow>
2. <https://www.deeplearning.ai/tensorflow-in-practice/>

Course Articulation matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	2	-	-	-	-	-	-	-	2	
CO2	-	2	-	-	3	-	-	-	3	-	-	-	-	3
CO3	-	3	-	-	3	-	-	-	3	3	-	-	-	3
CO4	-	-	2	2	3	-	-	-	2	2	-	-	2	3

Course Title	DATA SCIENCE		
Course Code	21CS772	L-T-P-C	(3-0-0)3
Exam Hrs.	3	Hours / Week	3
SEE	50 Marks	Total Hours	40
Course Objective: Students will be able to apply the data science process to real-time data.			
Course Outcomes (COs): Upon completion of the course, students shall be able to:			
#	Course Outcomes	Mapping to POs	Mapping to PSOs
1.	Describe the basic concepts of data science	1	-
2.	Apply different techniques for EDA using the R tool	2	-
3.	Apply supervised and unsupervised algorithms for a given problem	3,4	-
4.	Use data visualization tools and plot graphs.	5,9	1,2
Course Contents:			
MODULE – 1			10 Hrs
Introduction: What is Data Science? Big Data and Data Science hype - and getting past the hype, Why now? –Datafication, Current landscape of perspectives, Skill sets needed. Statistical Inference - Populations and samples, Statistical modelling, probability distributions, fitting a model.			
MODULE – 2			10 Hrs
Exploratory Data Analysis and the Data Science Process - Basic tools (plots, graphs and summary statistics) of EDA, Philosophy of EDA. The Data Science Process, Case Study: RealDirect (online real estate firm). Three Basic Machine Learning Algorithms - Linear Regression.			
MODULE – 3			10 Hrs
k-Nearest, Neighbors (k-NN), k-means. One More Machine Learning Algorithm and Usage in Applications -Motivating application: Filtering Spam, Why Linear Regression and k-NN are poor choices for Filtering Spam, Naive Bayes and why it works for Filtering Spam Data Wrangling: APIs and other tools for scrapping the Web.			
MODULE – 4			10 Hrs
Recommendation Systems: Building a User-Facing Data Product - Algorithmic ingredients of a Recommendation Engine, Dimensionality Reduction, Singular Value Decomposition, Principal Component Analysis, Exercise: build your own recommendation system. Data Visualization - Data Visualization History, What Is Data Science, Redux?, A Sample of Data Visualization Projects.			
Text Book: Cathy O’Neil and Rachel Schutt. Doing Data Science, Straight Talk from The Frontline. O'Reilly, 2014.			
Reference Books: 1. Jure Leskovek, Anand Rajaraman and Jeffery Ullman. Mining of Massive Datasets. V2.1, Cambridge University Press. 2004. 2. Kevin P. Murphy. Machine Learning: A Probabilistic Perspective. ISBN 0262018020. 2013. 3. Foster Provost and Tom Fawcett. Data Science for Business: What You Need to Know about DataMining andData-analytic Thinking. ISBN 1449361323. 2013.			
MOOCs: 1. Introduction to data Analytics nptel.ac.in/courses/110106064/E-Books: a) An Introduction toData Science. By J. Stanton, 2013. 2. Data Sciencehttps://drive.google.com/file/d/0B6iefdnF22XQeVZDSkxjZ0Z5VUE/edit			

Course Articulation matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	-	3	-	-	-	-	-	-	-	-	-	-	-	-
CO3	-	-	3	2	-	-	-	-	-	-	-	-	-	-
CO4	-	-	-	-	2	-	-	-	2	-	-	-	-	-

Course Title	MOBILE COMMUNICATIONS		
Course Code	21CS773	L-T-P-C	(3-0-0)3
Exam Hrs.	3	Hours / Week	3
SEE	50 Marks	Total Hours	40
Course Objective:	To apply knowledge of Mobile Communications and Technologies in real time applications.		
Course Outcomes (COs):	Upon completion of the course, students shall be able to:		
#	Course Outcomes	Mapping to POs	Mapping to PSOs
1.	Explore the applications, marketing and reference model of Mobile communication system.	1,2,3,12	-
2.	Classify the different types of transmissions, medium access control techniques and satellite Systems.	1, 2	-
3.	Develop the suitable wireless and/or mobile network for a given scenario.	3	-
4.	Study the performance of protocols involved in mobile network layer, mobile ad-hoc networks and transport layer.	2,4	-
Course Contents:			
MODULE – 1			10 Hrs
Introduction to Mobile Communications: Applications, History of Wireless Communication, A Market for Mobile Communications, Some open research Topics, A simplified reference model. Wireless Transmission: Frequencies for Radio Transmission, Signals, Antennas, Signal Propagation, Multiplexing, Modulation, Cellular Systems.			
MODULE – 2			10 Hrs
Medium Access Control: Motivation for a specialized MAC, TDMA, CDMA, Comparison of S/T/F/CDMA. Satellite Systems: History, Applications, Basics, Routing, Localizations, Handover; Broadcast Systems: Overview, Cyclical Repetition of data, DAB, DVB, Convergence of Broadcasting and Mobile communications.			
MODULE – 3			10 Hrs
Wireless LAN: Infrared versus radio transmission, Infrastructure and Adhoc Network, IEEE-802.11-System Architecture and Protocol Architecture. Mobile Network Layer: Mobile IP: Goals, assumptions and requirements, Entities and terminology, IP packet delivery, Agent discovery, Registration, Tunnelling and encapsulation, Optimizations; Dynamic host configuration protocol			
MODULE – 4			10 Hrs
Mobile ad-hoc networks: Routing, Destination sequence distance vector, Dynamic source routing, Alternative metrics , Overview ad-hoc routing protocols Mobile Transport Layer: Traditional TCP, Classical TCP improvements, TCP over 2.5/3G wireless networks, Performance enhancing proxies;			
Text Book: Jochen Schiller, Mobile communications, Pearson Education, 2nd edition			
Reference Books: 1. Asoke K. Talkukder, Roopa R Yavagal: Mobile Computing – Technology, Applications and Service Creation, Tata McGraw Hill, 2012 2. Reza B'Far: Mobile Computing Principles – Designing and Developing Mobile Applications with UML and XML, 5th Edition, Cambridge University press, 2013			

Course Title	SOFTWARE TESTING		
Course Code	21CS774	L-T-P-C	(3-0-0)3
Exam Hrs.	3	Hours/Week	3
SEE	50Marks	Total Hours	40
Course Objective: Apply effective testing techniques for developing quality software products.			
Course Outcomes(COs): Upon the completion of the course the students will be able to:			
#	Course Outcomes	Mapping to POs	Mapping to PSOs
1.	Explore the concepts of software testing and its documentation.	1,2	-
2.	Analyze various software testing methods and strategies	2,3	2
3.	Apply suitable test case generation techniques	3,5,9	2
4.	Ensure criteria for final certification of the software product	1,8	2
Course Contents:			
MODULE-1			10Hrs
Basics of Software Testing: Human Errors and Testing; Software Quality; Requirements, Behavior and Correctness; Correctness versus Reliability; Testing and Debugging; Test Metrics. Software and Hardware Testing; Testing and Verification; Defect Management; Execution History; Test-generation Strategies, Static Testing. Model-Based Testing and Model Checking; Control-Flow Graph; Types of Testing; The Saturation Effect.			
MODULE-2			10Hrs
Test Generation from Requirements: Introduction; The Test-Selection Problem; Equivalence Partitioning; Boundary Value Analysis; Category-Partition Method. Test Generation from Requirements: Cause-Effect Graphing, Test Generation from Predicates.			
MODULE-3			10Hrs
Structural Testing: Overview; Statement testing; Branch testing; Condition testing, Path testing; Procedure call testing; Comparing structural testing criteria; The infeasibility problem. Dependence, Data Flow Models, and Data Flow Testing: Definition-Use pairs; Data flow analysis; Classic analyses; From execution to conservative flow analysis; Data flow analysis with arrays and pointers; Inter-procedural analysis; Overview of data flow testing; Definition-Use associations; Data flow testing criteria; Data flow coverage with complex structures; The infeasibility problem.			
MODULE-4			10Hrs
Test Case Selection and Adequacy, Test Execution: Overview; Test specification and cases; Adequacy criteria; Comparing criteria; Overview of test execution; From test case specification to test cases; Scaffolding; Generic versus specific scaffolding; Test oracles; Self-checks as oracles; Capture and replay. Process: Test and analysis activities within a software process: The quality process; Planning and monitoring; Quality goals; Dependability properties; Analysis; Testing; Improving the process; Organizational factors. Integration and component-based software testing: Overview; Integration testing strategies; Testing components and assemblies. System, Acceptance and Regression Testing: Overview; System testing; Acceptance testing; Usability; Regression testing; Regression test selection techniques; Test case prioritization and selective execution.			
Text books : 1. Aditya P Mathur: Foundations of Software Testing, 2nd Edition, Pearson Education, 2014 (Chapters 1 excluding 1.15, 1.16, 1.17, 2, 6). 2. Mauro Pezze, Michal Young: Software Testing and Analysis – Process, Principles and Techniques, John Wiley & Sons, 2008 (Chapters 4, 6, 9, 12, 13, 17, 21, 22).			
Reference Books: 1. Srinivasan Desikan, Gopalaswamy Ramesh: Software testing Principles and Practices, 2nd Edition, Pearson, 2007. 2. Ron Patton: Software Testing, 2nd edition, Pearson, 2004.			

MOOC:<http://nptel.ac.in/courses/106105150>**Course Articulation matrix**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	3	-	-	-	-	-	-	-	-	-	-	-	-
CO2	-	2	3	-	-	-	-	-	-	-	-	-	-	2
CO3	-	-	3	-	3	-	-	-	2	-	-	-	-	3
CO4	2	-	-	-	-	-	-	2	-	-	-	-	-	1

Course Title	PRINCIPLES OF USER INTERFACE DESIGN		
Course Code	21CS775	(L-T-P)C	(3-0-0)3
Exam	3Hrs	Hours/Week	3
SEE	50 Marks	Total Hours	40
Course Objective: Students will be able to apply the concepts and principles of User Interface Design and evaluate User Interfaces.			
Course Outcomes (COs):		At the end of course, student will be able to:	
#	Course Outcomes	Mapping to PO's	Mapping to PSO's
1.	Demonstrate the theories and design processes of interactive systems	1	-
2.	Apply the principles of user interface design to improve visualization.	3	-
3.	Analyze different types of user interfaces, devices and quality of service issues	2	2
4.	Design appropriate user interface for the given application	3,5	2
MODULE – 1			10Hrs.
The User Interface-Introduction, Overview, the importance of user interface – Defining the user interface, The importance of Good design, Characteristics of graphical and web user interfaces, Principles of user interface design The User Interface Design process- Obstacles, Usability, Human characteristics in Design.			
MODULE – 2			10Hrs.
Human Interaction speeds, Business Functions-Business definition and requirement analysis, Basic business functions, Design standards. System menus and navigation schemes- Structures of menus, Functions of menus, Contents of menus.			
MODULE -3			10Hrs.
Formatting of menus, Phrasing the menu, selecting menu choices, Navigating menus, Kinds of graphical menus. Windows - Characteristics, Components of window, Window presentation styles, Types of window, Window management.			
MODULE -4			10Hrs.
Organizing window functions, Window operations, Web systems, Characteristics of device-based controls. Screen based controls- Operable control, Text control, Selection control, Custom control, Presentation control, Windows Tests-prototypes, kinds of tests.			
Text Books: Wilbert O. Galitz, “The Essential Guide to User Interface Design”, John Wiley & Sons, Second Edition 2002.			
Reference Books: 1. Ben Sheiderman, “Design the User Interface”, Pearson Education, 1998. 2. Alan Cooper, ”The Essential of User Interface Design”, Wiley- Dream Tech Ltd.,2002			
MOOC Course: User Interface Design https://nptel.ac.in/noc/courses/noc19/SEM1/noc19-ar10/			

Course Articulation matrix

[illegible]

Course Title	PROJECT MANAGEMENT AND FINANCE		
Course Code	21CS776	(L-T-P)C	(3-0-0)3
Exam	3 Hrs.	Hours/Week	3
SEE	50 Marks	Total Hours	40
Course Objective:	Understand the techniques of Project Management.		
Course Outcomes (COs)	At the end of course, student will be able to:		
#	Course Outcomes	Mapping to PO's	Mapping to PSO's
1.	Describe the role, importance and Concepts of Project Management.	1	-
2.	Explore project organization structures.	1	-
3.	Elucidate management functions to handle the team.	1	-
4.	Estimate the project cost.	3	2
Course Contents:			
MODULE – 1			10 Hrs.
Introduction: Understanding Project Management, The Project Manager–Line Manager Interface, Defining the Project Manager’s Role, Defining the Functional Manager’s Role, Defining the Functional Employee’s Role, Defining the Executive’s Role, Working with Executives, The Project Manager as the Planning Agent, Project-Driven versus Non–Project-Driven Organizations, Marketing in the Project-Driven Organization; PROJECT MANAGEMENT GROWTH: CONCEPTS AND DEFINITIONS: General Systems Management, Resistance to Change, Systems, Programs, and Projects: A Definition, Product versus Project Management: A Definition, Maturity and Excellence: A Definition, Informal Project Management: A Definition, The Many Faces of Success, The Many Faces of Failure, The Stage-Gate Process, Project Life Cycles, Project Management Methodologies: A Definition, Organizational Change Management and Corporate Cultures, Project Management Intellectual Property, Systems Thinking;			
MODULE – 2			10 Hrs.
ORGANIZATIONAL STRUCTURES: Introduction, Organizational Work Flow, Traditional (Classical) Organization, Developing Work Integration Positions, Line–Staff Organization (Project Coordinator), Pure Product (Projectized) Organization, Matrix Organizational Form, Modification of Matrix Structures, Selecting the Organizational Form, Structuring the Small Company; ORGANIZING AND STAFFING THE PROJECT OFFICE AND TEAM: Introduction, The Staffing Environment, Selecting the Project Manager: An Executive Decision, Skill Requirements for Project and Program Managers, Special Cases in Project Manager Selection, Selecting the Wrong Project Manager, Duties and Job Descriptions, The Organizational Staffing Process, The Project Office;			
MODULE -3			10 Hrs.
MANAGEMENT FUNCTIONS: Introduction, Controlling, Directing, Project Authority, Interpersonal Influences, Barriers to Project Team Development, Suggestions for Handling the Newly Formed Team, Team Building as an Ongoing Process, Dysfunctions of a Team, Leadership in a Project Environment, Life-Cycle Leadership, Organizational Impact, Employee–Manager Problems, Management Pitfalls, MANAGEMENT OF YOUR TIME AND STRESS: Introduction, Understanding Time Management, Time Robbers, Time Management Forms, Effective Time Management, Stress and Burnout.			
MODULE -4			10 Hrs.

Text Book:
Project Management: A System approach to planning Scheduling & Controlling, Harold Kerzner,
10th edition 2009, John Wiley & sons

1. A management guide to PERT and CPM Wesit & Levy Eastern economy edition of PHL,2011
2. Project planning, scheduling & control James P lewis Meo publishing company,2010.

[illegible]

Course Title	DIGITAL IMAGE ANALYSIS		
Course Code	21CS781	L-T-P-C	(3-0-0)3
Exam Hrs.	3	Hours/Week	3
SEE	50 Marks	Total Hours	40
Course Objective: To study the mathematical transforms necessary for image processing along with data handling techniques. Course Outcomes(COs): Upon completion of the course, students shall be able to:			
#	Course Outcomes	Mapping to POs	Mapping to PSOs
1	Explain the mathematical methods used for Image Analysis	1, 2	-
2	Apply the concepts of shape theory in a Digital Image Processing	1, 2	-
3	Analyze various data handling techniques used in Image Analysis.	2, 3	-
4	Represent image in the form of a graph.	3	-
Course Contents:			
MODULE-1			10 Hrs
Numerical Harmonic Analysis and Image Processing: Gabor Analysis and Digital Signal Processing - From Fourier to Gabor Expansions, Local Time-Frequency Analysis and STFT, Fundamental Properties of Gabor Frames, Commutation Relations of the Gabor Frame Operator, Critical Sampling, Oversampling, and the Balian-Low Theorem, Wexler-Raz Duality Condition, Gabor Analysis on LCA Groups, Numerical Gabor Analysis, Image Representation and Gabor Analysis, Signal and Image Reconstruction – Notation, Signal Reconstruction and Frames, Numerical Methods for Signal Reconstruction, Examples and Applications - Object Boundary Recovery in Echocardiography, Image Reconstruction in Exploration Geophysics, Reconstruction of Missing Pixels in Images			
MODULE-2			10 Hrs
Stochastic Shape Theory: Shape Analysis, Contour Line Parameterization, Deformable Templates - Stochastic Planar Deformation Processes, Gaussian Isotropic Random Planar Deformations, The Deformable Templates Model, Maximum Likelihood Classification, The Wavelet Transform - Atomic Decompositions and Group Theory, Discrete Wavelets and Multiscale Analysis, Wavelet Packets, Wavelet Packet Descriptors, Global Nonlinear Optimization - Multilevel Single-Linkage Global Optimization, Implementation			
MODULE-3			10 Hrs
Data Handling: Parallel and Distributed Processing - Dealing with Large Remote Sensing Image Data Sets - , Parallel Radar Signal Processing, Parallel Radar Image Processing, Distributed Processing			
MODULE-4			10 Hrs
Robust and Adaptive Image Understanding: Graphs in Image Analysis - From Pixels to Graphs, Graphs in the Square Grid, Run Graphs, Area Voronoi Diagram, Graph Transformations in Image Analysis - Arrangements of Image Elements, Dual Graph Contraction, Hierarchies: Regular Image Pyramids, Structure, Contents, Processing, Fuzzy Curve Pyramid, Irregular Graph Pyramids - Computational Complexity, Irregular Pyramids by Hopfield Networks, Equivalent Contraction Kernels, Extensions to 3D			
Text Book: Digital Image Analysis Selected Techniques and Applications, Walter G. Kropatsch, Horst Bischof.			
Reference Books: 1. Rafael C. Gonzales, Richard E. Woods, “Digital Image Processing”, 4th Edition, Pearson publications, 2018 2. A.K. Jain, “Fundamentals of Digital Image Processing”, Pearson 2nd Edition, 2018. 3. Scott E Umbaugh “DIGITAL IMAGE PROCESSING AND ANALYSIS - Human and Computer Vision Applications with CVIPtools” CRC Press 2nd Edition 2011			

MOOCs:

<https://www.edx.org/learn/image-analysis/ecole-polytechnique-federale-de-lausanne-image-processing-and-analysis-for-life>

MOOCs:

<https://www.edx.org/learn/image-analysis/ecole-polytechnique-federale-de-lausanne-image-processing-and-analysis-for-life>

Course Articulation matrix

[illegible]

Course Title	BIG DATA ANALYTICS		
Course Code	21CS782	L-T-P-C	(3-0-0)3
Exam Hrs.	3	Hours/Week	3
SEE	50 Marks	Total Hours	40
Course Objective: Acquire the knowledge to handle Big Data.			
Course Outcomes(COs): Upon completion of the course the students will be able to:			
#	Course Outcomes	Mapping to POs	Mapping to PSOs
1.	Describe basic concepts of Big data analytics	1	-
2.	Apply Big data framework for data analysis	2,3	-
3.	Use Big data tools and techniques in processing of data	3,5,9,10	1,2
Course Contents:			
MODULE – 1			10Hrs
Introduction: Velocity, Variety, Veracity; Drivers for Big Data, Sophisticated Consumers, Automation, Monetization. Big Data Analytics Applications: Social Media Command Center, Product Knowledge Hub, Infrastructure and Operations Studies, Product Selection, Design and Engineering, Location-Based Services, Online Advertising, Risk Management.			
MODULE – 2			10Hrs
Architecture Components: Massively Parallel Processing (MPP) Platforms, Unstructured Data Analytics and Reporting: Search and Count, Context-Sensitive and Domain-Specific Searches, Categories and Ontology, Qualitative Comparisons, Data Privacy Protection, Real-Time Adaptive Analytics and Decision Engines. Advanced Analytics Platform: Real-Time Architecture for Conversations, Orchestration and Synthesis Using Analytics Engines, Entity Resolution, Model Management, Discovery Using Data at Rest, Integration Strategies.			
MODULE – 3			10Hrs
Implementation of Big Data Analytics: Revolutionary, Evolutionary, or Hybrid, Big Data Governance, Integrating Big Data with MDM, Evolving Maturity Levels. Map-Reduce and the New Software Stack 1: Distributed File Systems. Physical Organization of Compute Nodes, Large-Scale File-System Organization, Map-Reduce features: Map Tasks, Grouping by Key, Reduce Tasks, Combiners, Map-Reduce Execution, Coping With Node Failures.			
MODULE – 4			10Hrs
Map-Reduce and the New Software Stack 2: Algorithms Using Map-Reduce for Matrix multiplication, Relational Algebra operations, Workflow Systems. Recursive Extensions to Map-Reduce. Communication Cost Models: Complexity Theory for Map-Reduce, Reducer Size and Replication Rate, Graph Model and Mapping Schemas, Lower Bounds on Replication Rate. Mining Data Streams: Stream Data Model and Management Stream Source, Stream Queries, and issues, Sampling Data in a Stream, Filtering Streams, Counting Distinct Elements in a Stream, Estimating Moments, Counting Ones in a Window, Decaying Windows.			
Text Books:			
1. Big Data Analytics: Disruptive Technologies for Changing the Game, Dr. Arvind Sathi, First Edition October 2012, IBM Corporation. 2. Mining of Massive Datasets, Anand Rajarama, Jure Leskovec, Jeffrey D. Ullman. E-book, 2013.			

Reference Books:

1. Big Data Imperatives, Soumendra Mohanty, Madhu Jagadeesh, Harsha Srivatsa, A press, e-book of 2012.
2. Michael Minelli, Michehe Chambers, “Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today’s Business”, 1st Edition, Ambiga Dhiraj, Wiely CIO Series, 2013.
3. Bill Franks, “Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics”, 1st Edition, Wiley and SAS Business Series, 2012
4. Big Data Imperatives, Soumendra Mohanty, Madhu Jagadeesh, Harsha Srivatsa, Apress, e-book of 2012.

MOOC:

<https://nptel.ac.in/courses/106/104/106104189>

Course Articulation matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	-	3	3	-	-	-	-	-	-	-	-	-	-	-
CO3	-	-	3	-	2	-	-	-	2	2	-	-	2	1

Course Title	STORAGE AREA NETWORKS		
Course Code	21CS783	L-T-P-C	(3-0-0)3
Exam Hrs.	3	Hours/Week	3
SEE	50 Marks	Total Hours	40
Course Objective:	Analyze various Storage Area Networks.		
Course Outcomes(COs):	Upon completion of the course, students shall be able to:		
#	Course Outcomes	Mapping to POs	Mapping to PSOs
1.	Demonstrate different RAID levels.	1	-
2.	Explain the components of Storage Area Network (SAN).	1	2
3.	Explore Storage Area Network.	1	2
4.	Explain the concepts of Network Attached Storage(NAS).	1	2
Course Contents:			
MODULE – 1			10 Hrs
Introduction: Server Centric IT Architecture and its Limitations; Storage – Centric IT Architecture and its advantages, Case study: Replacing a server with Storage Networks, Architecture of Intelligent Disk Subsystems, Hard disks and Internal I/O Channels. Intelligent Disk Subsystem: JBOD, Storage virtualization using RAID, different RAID levels; Caching: Acceleration of Hard Disk Access; Instant copies, Remote mirroring, LUN masking, Availability of disk subsystems.			
MODULE – 2			10 Hrs
I/O Technique: The Physical I/O path from the CPU to the Storage System; SCSI; Fibre Channel Protocol Stack-links, ports, topologies, FC-0,FC-1,FC-2,FC-3, link services, FC-4. Fiber channel SAN, Network Attached Storage: Fiber Channel SAN-point-to-point topology, fabric topology, arbitrated loop topology, hardware components, IP Storage-IP storage standards: iscsi, iFCP, Mfcp, FCIP. The NAS hardware Architecture, The NAS Software Architecture, Network connectivity.			
MODULE – 3			10 Hrs
File System: Local File Systems; Network file Systems and file servers: basic principle, NAS, performance bottle necks, acceleration of network file systems, case study-DAFS; Shared Disk file systems; Comparison: NAS, fiber Channel SAN and iSCSI SAN. Storage Virtualization: Definition of Storage virtualization; Implementation Considerations; Storage virtualization on Block or file level; Storage virtualization on various levels of the storage Network; Symmetric and Asymmetric storage virtualization in the Network.			
MODULE – 4			10 Hrs
SAN Architecture and Hardware devices: Creating a Network for storage-The network part, The software -fabric OS services, The connectivity part- connecting server, connecting the storage, SAN Hardware devices- The fiber channel switch, Host Bus adaptors. Software Components of SAN: The switch's operating system, Device Drivers, The Supporting components.			
Text Books : 1. Ulf Troppens, Rainer Erkens and Wolfgang Muller: Storage Networks Explained, Second Edition Wiley India, 2009 2. Robert Spalding: Storage Networks, The Complete Reference, Tata McGraw Hill, 2003. (Ch. 9, 13, 14, 15)			
Reference Book: Richard Barker and Paul Massiglia: Storage Area Network Essentials A Complete Guide to understanding and Implementing SANs, John Wiley India, 2002			
MOOC: https://onlinecourses.nptel.ac.in/noc18_cs50/preview			

Course Articulation matrix

[illegible]

Course Title	GREEN COMPUTING		
Course Code	21CS784	L-T-P-C	(3-0-0)3
Exam Hrs.	3	Hours/Week	3
SEE	50 Marks	Total Hours	40
Course Objective: To enable students to design, manufacture, and dispose computing devices in a way that reduces their environmental impact.			
Course Outcomes(COs): Upon completion of the course, students shall be able to:			
#	Course Outcomes	Mapping to POs	Mapping to PSOs
1.	Explore fundamentals of Green Computing	1,7	-
2.	Analyze various sustainability challenges and strategies that can reduce the environmental impact of usage of computers	2,7	-
3.	Relate the green computing practices to make business more energy efficient and Green compliant.	6,11	-
4.	Document and present the technical paper with proposed sustainable solution for Green Computing.	3,4,7,8,9,10	-
Course Contents:			
MODULE – 1			10 Hrs
Green IT: An Overview, Introduction, Environmental Concerns and Sustainable Development, Environmental Impacts of IT, Green IT, Holistic Approach to Greening IT, Greening IT, Applying IT for enhancing Environmental sustainability, Green IT Standards and Eco-Labeling of IT, Enterprise Green IT strategy, Green IT: Burden or Opportunity, Green Devices and Hardware: Introduction, Life Cycle of a device or hardware, Reuse, Recycle and Dispose. Green Software: Introduction, Energy-saving software techniques, Evaluating and Measuring software Impact to platform power. Sustainable Software Development: Introduction, Current Practices, Sustainable Software, Software Sustainability Attributes, Software Sustainability Metrics			
MODULE – 2			10 Hrs
Green Data Centres: Data Centres and associated energy challenges, Data centre IT infrastructure, Data Centre facility infrastructure: Implications for energy efficiency, IT infrastructure management. Green Networks and Communications: Introduction, Objectives of Green Network Protocols, Green Network Protocols and Standards. Enterprise Green IT Strategy: Introduction, Approaching Green IT Strategies, Business Drivers of Green IT Strategy, Business Dimensions for Green IT Transformation, Organizational Considerations in a Green IT Strategy, Steps in Developing a Green IT Strategy. Green Enterprises and Role of IT: Introduction, Organization and Enterprise Greening, Information systems in Greening Enterprises, Greening Enterprise: IT Usage and Hardware, Inter-Organizational Enterprise activities and Green Issues.			
MODULE – 3			10 Hrs
Managing Green IT: Introduction, Strategizing Green Initiatives, Implementation of Green IT, Information Assurance. Regulating Green IT: Laws, Standards and Protocols: Introduction, The regulatory environment and IT manufacturers, Non regulatory government initiatives, Industry associations and standards bodies, Green building standards, Green data centres, Social movements and Greenpeace Green Cloud Computing and Environmental Sustainability: Introduction, what is Cloud Computing? Cloud Computing and Energy Usage Model: A Typical Example, Features of Clouds Enabling Green Computing, Towards Energy Efficiency of Cloud Computing, Green Cloud Architecture			

MODULE – 4	10 Hrs
Harnessing Semantic Web Technologies for the Environmental: Introduction, Information Management for Environmental Sustainability, Ecosystem of Software Tools, Examples of Managing Data. Green IT-An Outlook: Introduction, Awareness to implementations, Greening by IT, Green IT: A megatrend, A seven-step approach to creating green IT strategy, Research and Development directions.	
Text Book: Harnessing Green IT: Principles and Practices , San Murugesan, G. R. Gangadharan. ,1 st Edition ,Wiley& IEEE 2017.	
Reference Books: 1. Green IT Strategies and Applications-Using Environmental Intelligence, BhuvanUnhelkar ,1 st Edition, CRC Press 2011 2. Green Communications: Principles, Concepts and Practice Konstantinos Samdanis, Peter Rost, Andreas Maeder, Michela Meo, Christos Verikoukis ,1 st Edition, Wiley 2015.	

Course Articulation matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	-	-	3	-	-	-	-	-	-	-
CO2	-	2	-	-	-	-	2	-	-	-	-	-	-	-
CO3	-	-	-	-	-	3	-	-	-	-	2	-	-	-
CO4	-	-	2	2	-	-	2	3	3	3	-	-	-	-

Course Title	ADVANCED WEB TECHNOLOGY		
Course Code	21CS785	(L-T-P) C	(3-0-0)3
Exam. Hrs	3	Hours/Week	3
SEE	50 Marks	Total Hours	40
Course Objective: To apply the concepts of Full stack web development with Django framework for real world applications.			
Course Outcomes (COs): Upon completion of the course, students shall be able to:			
#	Course Outcomes	Mapping To PO's	Mapping to PSO's
1.	Explore the working of MVT based full stack web development with Django.	1	-
2.	Design Models and Forms for rapid development of web pages.	3	2
3.	Demonstrate the role of Template Inheritance and Generic views	1	-
4.	Apply the Django framework to create web applications	3,5,9,12	1,2
Course Contents			
MODULE– 1			10Hrs.
MVC based Web Designing: Web framework, MVC Design Pattern, Django Evolution, Views, Mapping URL to Views, Working of Django URL Confs and Loose Coupling, Errors in Django, Wild Card patterns in URLS.			
MODULE– 2			10Hrs.
Django Templates and Models: emplate System Basics, Using Django Template System, Basic Template Tags and Filters, MVT Development Pattern, Template Loading, Template Inheritance, MVT Development Pattern. Configuring Databases, Defining and Implementing Models, Basic Data Access, Adding Model String Representations, Inserting/Updating data, Selecting and deleting objects, Schema Evolution			
MODULE-3			10Hrs.
FDjango Admin Interfaces and Model Forms: Activating Admin Interfaces, Using Admin Interfaces, Customizing Admin Interfaces, Reasons to use Admin Interfaces. Form Processing, Creating Feedback forms, Form submissions, custom validation, creating Model Forms, URLConf Ticks, Including Other URLConfs.			
MODULE-4			10Hrs.
Generic Views and Django State Persistence: Using Generic Views, Generic Views of Objects, Extending Generic Views of objects, Extending Generic Views. MIME Types, Generating Non-HTML contents like CSV and PDF, Syndication Feed Framework, Sitemap framework, Cookies, Sessions, Users and Authentication.			
Text Book: Adrian Holovaty, Jacob Kaplan Moss, The Definitive Guide to Django: Web Development Done Right, Second Edition, Springer-Verlag Berlin and Heidelberg GmbH & Co. KG Publishers, 2009			
ReferenceBooks: 1. Aidas Bendroraitis, Jake Kronika, Django 3 Web Development Cookbook, Fourth Edition, Packt Publishing, 2020 2. William Vincent, Django for Beginners: Build websites with Python and Django, First Edition, Amazon Digital Services, 2018 3. Antonio Mele, Django3 by Example, 3rd Edition, Pack Publishers, 2020 4. Arun Ravindran, Django Design Patterns and Best Practices, 2nd Edition, Pack Publishers, 2020. 5. Julia Elman, Mark Lavin, Light weight Django, David A. Bell, 1st Edition, Oreily Publications,			

2014 .

Weblinks and Video Lectures (e-Resources):

1. MVT architecture with Django: <https://freevidelectures.com/course/3700/django-tutorials>
2. Using Python in Django: <https://www.youtube.com/watch?v=2BqoLiMT3Ao>
3. Model Forms with Django: <https://www.youtube.com/watch?v=gMM1rtTwKxE>
4. Real time Interactions in Django: <https://www.youtube.com/watch?v=3gHmfoeZ45k>
5. AJAX with Django for beginners: <https://www.youtube.com/watch?v=3VaKNyjlxAU>

Course Articulation matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-		-	-	-	-	-	-	-	-	-	-	-
CO2	-	-	3	-	-	-	-	-	-	-	-	-	-	2
CO3	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO4	-	-	3	-	2	-	-	-	2	-	-	2	2	2

Course Title	SOFTWARE METRICS		
Course Code	21CS786	L-T-P-C	(3-0-0)3
Exam Hrs.	3	Hours / Week	3
SEE	50 Marks	Total Hours	40
Course Objective: Acquire the knowledge to measure the quality and health of software development process			
Course Outcomes (COs) : Upon Completion of the course, students shall be able to:			
#	Course Outcomes	Mapping to POs	Mapping to PSOs
1.	Explain fundamentals of measurement and software metrics	1	-
2.	Apply frame work and analysis techniques for software measurement.	2	-
3.	Estimate efforts involved in software product development using internal attributes	2	2
Course Contents:			
MODULE – 1			10 Hrs
Fundamentals of Measurement: Measurement: what is it and why do it?: Measurement in Software Engineering, Scope of Software Metrics, The Basics of measurement: The representational theory of measurement, Measurement and models, Measurement scales and scale types, meaningfulness in measurement.			
MODULE – 2			10 Hrs
A Goal-Based Framework For Software Measurement: Classifying software measures, Determining what to Measure, Applying the framework, Software measurement validation, Performing Software Measurement validation Empirical investigation: Principles of Empirical Studies, Planning Experiments, Planning case studies as quasi-experiments , Relevant and Meaningful Studies			
MODULE – 3			10 Hrs
Software Metrics Data Collection: Defining good data , Data collection for incident reports, How to collect data, Reliability of data collection Procedures Analyzing software measurement data: Statistical distributions and hypothesis testing, Classical data analysis techniques, Examples of simple analysis techniques			
MODULE – 4			10 Hrs
Measuring internal product attributes: Size Properties of Software Size, Code size, Design size, Requirements analysis and Specification size, Functional size measures and estimators, Applications of size measures Measuring internal product attributes: Structure: Aspects of Structural Measures, Control flow structure of program units, Design-level Attributes, Object-oriented Structural attributes and measures			
Text Book:			
Software Metrics A Rigorous and Practical Approach, Norman Fenton, James Bieman , Third Edition, 2014.			
Reference Books:			
1. Software metrics, Norman E, Fenton and Shari Lawrence Pfleeger, International Thomson Computer Press, 1997 2. Metric and models in software quality engineering, Stephen H.Kan, Second edition, 2002, Addison-			

Wesley Professional. - Measuring the Software Process, William A. Florac and Areitor D. Carletow, 1995, Addison – Wesley. - Practical Software Metrics for Project Management and Process Improvement, Robert B.Grady, 1992, Prentice Hall.

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|---|
| <p>Wesley Professional.</p> <ol style="list-style-type: none"> Measuring the Software Process, William A. Florac and Areitor D. Carletow, 1995, Addison – Wesley. Practical Software Metrics for Project Management and Process Improvement, Robert B.Grady, 1992, Prentice Hall. |
|---|

MOOCs: 1. https://nptel.ac.in/courses/106106212 2. https://nptel.ac.in/courses/106106145

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|---|
| MOOCs:
1. https://nptel.ac.in/courses/106106212
2. https://nptel.ac.in/courses/106106145 |
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Course Articulation matrix

[illegible]

Course Title	INTRODUCTION TO PYTHON PROGRAMMING		
Course Code	21OECS71	L-T-P-C	(3-0-0)3
SEE duration	3 hours	Hours / Week	3
SEE marks	50	Total hours	40
Course Objective: Student's will be able to write a python program to solve the given problem			
Course Outcomes (COs): Upon completion of the course, students shall be able to:			
#	Course Outcomes	Mapping to POs	Mapping to PSOs
1.	Describe and apply python language construct for writing a program	1,3,5	-
2.	Analyze the codes snippet for its correctness	2,5	-
3.	Design a GUI/python program for the given problem	3,5	1,2
Course Contents:			
MODULE 1			10 Hours
Python Basics: The way of Programming. Variables, Expression and Entering Expressions into the Interactive Shell. The Integer, Floating-Point, and String Data Types, String Concatenation and Replication, Storing Values in Variables, Your First Program, Dissecting Your Program, Flow control: Boolean Values, Comparison Operators, Boolean Operators, Mixing Boolean and Comparison Operators, Elements of Flow Control, Program Execution, Flow Control Statements, Importing Modules, Ending a Program Early with sys.exit(). Loops for iteration.			
MODULE 2			10 Hours
Functions: def Statements with Parameters, Return Values and return Statements, The None Value, Keyword Argument sandprint(). Local and Global Scope, The global Statement. Exception Handling, A Short Program: Guess the Number. Manipulating Strings: Working with Strings, Useful String Methods.			
MODULE 3			10 Hours
Lists: The List Data Type, Working with Lists, Augmented Assignment Operators, Methods, Example Program: Magic 8 Ball with a List. List-like Types: Strings and Tuples. Dictionaries: The Dictionary Data Type, Pretty Printing.			
MODULE 4			10 Hours
GUI Programming: Tkinter Introduction, Tkinter and Python programming, Widgets Label, Button, Entry, Scaling, Menu, Check Box, Radio button. Tkinter examples			
Text Books : 1. Al Sweigart, "Automate the Boring Stuff with Python", 1 st Edition. No Starch Press, 2015. 2. Wesley J Chun, "Core Python Application Programming", 3 rd Edition, Pearson Publication, 2016.			
Reference Book: R. Nageswara Rao, "Core Python Programming", 3 rd Edition, Dream tech Press			
MOOC: https://onlinecourses.nptel.ac.in/noc21_cs32/			

Course Title	IOT AND ITS APPLICATIONS		
Course Code	21OECS72	L-T-P-C	(3-0-0)3
Exam Hrs.	3	Hours / Week	3
SEE	50 Marks	Total Hours	40
Course Objective: Explore the interconnection and integration of the physical world and design IOT applications. Course Outcomes (COs) : Upon the completion of the course the students will be able to:			
#	Course Outcomes	Mapping to POs	Mapping to PSOs
1.	Explain the impact and challenges posed by IoT networks, compare IoT architectures	1	-
2.	Illustrate smart objects and IoT Access Technologies to leverage connectivity.	1	-
3.	Design IoT interface module using RaspberryPi for a given problem.	2,3	2
Course Contents:			
MODULE – 1			10 Hrs
What is IoT, Genesis of IoT, IoT and Digitization, IoT Impact, Convergence of IT and IoT, IoT Challenges, IoT Network Architecture and Design, Drivers Behind New Network Architectures, Comparing IoT Architectures, A Simplified IoT Architecture, IoT Data Management and Compute Stack.			
MODULE – 2			10 Hrs
Smart Objects: The “Things” in IoT, Sensors, Actuators, and Smart Objects, Sensor Networks, Connecting Smart Objects: Communications Criteria, IoT Access Technologies: IEEE 802.15.4, IEEE 802.15.4g and IEEE 802.15.4e.			
MODULE – 3			10 Hrs
IP as the IoT Network Layer: The Business Case for IP, The need for Optimization, Optimizing IP for IoT, Profiles and Compliances. Application Protocols for IoT: The Transport Layer, IoT Application Transport Methods.			
MODULE – 4			10 Hrs
IoT Physical Devices and Endpoints - RaspberryPi: Introduction to RaspberryPi, Exploring the RaspberryPi Board; Operating System setup on RaspberryPi, RaspberryPi commands, Programming RaspberryPi with Python. Securing IoT: A Brief History of OT Security, Common Challenges in OT Security, How IT and OT Security Practices and Systems Vary, Formal Risk Analysis Structures: OCTAVE and FAIR, The Phased Application of Security in an Operational Environment.			
Text Books:			
1. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Robert Barton, Jerome Henry, "IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things", 1st Edition, Pearson Education (Cisco Press Indian Reprint). (ISBN: 978-9386873743). 2. Srinivasa K G, Siddesh G M Hanumantha Raju R “Internet of Things”, CENGAGE Learning India, 2017.			

Reference Books: 1. Internet of Things - A Hands on Approach, Arshdeep Bahga and Vijay Madisetti Universities Press, 2015. 2. Olivier Hersent, David Boswarthick, Omar Elloumi, The Internet of Things: Key Applications and Protocols, 2nd Edition, Wiley ISBN: 978-1-119-99435-0, 370 pages, January 2012.

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|---|
| <p>Reference Books:</p> <ol style="list-style-type: none"> 1. Internet of Things - A Hands on Approach, Arshdeep Bahga and Vijay Madisetti Universities Press, 2015. 2. Olivier Hersent, David Boswarthick, Omar Elloumi, The Internet of Things: Key Applications and Protocols, 2nd Edition, Wiley ISBN: 978-1-119-99435-0, 370 pages, January 2012. |
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Course Articulation matrix

[illegible]

Course Title	BIG DATA ANALYTICS		
Course Code	21OECS73	L-T-P-C	(3-0-0)3
Exam Hrs.	3	Hours/Week	3
SEE	50 Marks	Total Hours	40
Course Objective: Acquire the knowledge to handle Big Data.			
Course Outcomes(COs): Upon completion of the course the students will be able to:			
#	Course Outcomes	Mapping to POs	Mapping to PSOs
1.	Describe basic Concepts of Big data Analytics	1	-
2.	Apply Big data framework for data analysis	2,3	-
3.	Use Big Data tools and techniques in processing of data	3,5,9,10	1,2
Course Contents:			
MODULE-1			10Hrs
Introduction: Velocity, Variety, Veracity; Drivers for Big Data, Sophisticated Consumers, Automation, Monetization. Big Data Analytics Applications: Social Media Command Center, Product Knowledge Hub, Infrastructure and Operations Studies, Product Selection, Design and Engineering, Location-Based Services, Online Advertising, Risk Management.			
MODULE-2			10Hrs
Architecture Components: Massively Parallel Processing (MPP) Platforms, Unstructured Data Analytics and Reporting: Search and Count, Context-Sensitive and Domain-Specific Searches, Categories and Ontology, Qualitative Comparisons, Data Privacy Protection, Real-Time Adaptive Analytics and Decision Engines. Advanced Analytics Platform: Real-Time Architecture for Conversations, Orchestration and Synthesis Using Analytics Engines, Entity Resolution, Model Management, Discovery Using Data at Rest, Integration Strategies.			
MODULE-3			10Hrs
Implementation of Big Data Analytics: Revolutionary, Evolutionary, or Hybrid, Big Data Governance, Integrating Big Data with MDM, Evolving Maturity Levels. Map-Reduce and the New Software Stack: Distributed File Systems. Physical Organization of Compute Nodes, Large-Scale File-System Organization, Map-Reduce features: Map Tasks, Grouping by Key, Reduce Tasks, Combiners, Map-Reduce Execution, Coping With Node Failures.			
MODULE-4			10Hrs
Communication Cost Models: Complexity Theory for Map-Reduce, Reducer Size and Replication Rate, Graph Model and Mapping Schemas, Lower Bounds on Replication Rate. Mining Data Streams, Stream Data Mode l and Management Stream Source, Stream Queries, and issues, Sampling Data in a Stream, Filtering Streams, Counting Distinct Elements in a Stream, Estimating Moments, Counting Ones in a Window, Decaying Windows.			
Text Books: 1. Big Data Analytics: Disruptive Technologies for Changing the Game, Dr. Arvind Sathi, First Edition October 2012, IBM Corporation. 2. Mining of Massive Datasets, Anand Rajarama, Jure Leskovec, Jeffrey D. Ullman. E-book, 2013.			

Reference Books:

1. Big Data Imperatives, Soumendra Mohanty, Madhu Jagadeesh, Harsha Srivatsa, A press, e-book of 2012.
2. Michael Minelli, Michehe Chambers, “Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today’s Business”, 1st Edition, Ambiga Dhiraj, Wiely CIO Series, 2013.
3. Bill Franks, “Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics”, 1st Edition, Wiley and SAS Business Series, 2012
4. Big Data Imperatives, Soumendra Mohanty, Madhu Jagadeesh, Harsha Srivatsa, Apress, e-book of 2012.

MOOC:

<https://nptel.ac.in/courses/106/104/106104189>

Course Articulation matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	-	3	2	-	-	-	-	-	-	-	-	-	-	-
CO3	-	-	3	-	3	-	-	-	2	2	-	-	2	1

Course Title	WEB TECHNOLOGY		
Course Code	21OECS74	L-T-P-C	(3-0-0)3
Exam Hrs.	3	Hours / Week	3
SEE	50 Marks	Total Hours	40
Course Objective:	Create web pages with client side and server-side scripting.		
Course Outcomes (COs):	Upon completion of the course, students shall be able to:		
#	Course Outcomes	Mapping to POs	Mapping to PSOs
1.	Explain the concepts of HTML and scripting languages	1	-
2.	Develop dynamic web pages using JavaScript	3	-
3.	Develop client-side script to design webpage	3	-
4.	Design server-side script using PHP and MySQL	3,5	-
Course Contents:			
MODULE – 1			10 Hrs
Introduction to HTML , What is HTML and Where did it come from?, HTML Syntax, Semantic Markup, Structure of HTML Documents, Quick Tour of HTML Elements, HTML5 Semantic Structure Elements, Introduction to CSS, What is CSS, CSS Syntax, Location of Styles, Selectors, The Cascade: How Styles Interact, The Box Model, CSS Text Styling.			
MODULE – 2			10 Hrs
HTML Tables and Forms , Introducing Tables, Styling Tables, Introducing Forms, Form Control Elements, Table and Form Accessibility, Microformats, Advanced CSS: Layout, Normal Flow, Positioning Elements, Floating Elements, Constructing Multicolumn Layouts, Approaches to CSS Layout, Responsive Design, CSS Frameworks.			
MODULE – 3			10 Hrs
JavaScript and HTML Documents: The JavaScript execution environment; Element access in JavaScript; Events and event handling; Handling events from the Body elements, Button elements, Text box and Password elements; The navigator object. Dynamic Documents with JavaScript: Introduction to dynamic documents; Element positioning; Moving elements; Element visibility; Changing colors and fonts; Dynamic content; Stacking elements; Locating the mouse cursor.			
MODULE – 4			10 Hrs
XML: Introduction; Syntax; Document structure; Namespaces, XML schemas, Displaying raw XML documents; Displaying XML documents with CSS; XSLT style sheets. PHP: Origins and uses of PHP; Overview of PHP; General syntactic characteristics; Primitives, operations and expressions; Output; Control statements; Arrays; Functions; Pattern matching; Form handling; Files; Cookies; Session tracking; Database Access using PHP and MySQL.			
Text Book: Robert W. Sebesta: Programming the World Wide Web, 8th Edition, Pearson Education, 2014.			
Reference Books: 1. Deitel H.M. and Deitel P.J., “Internet and World Wide Web How to program”, Pearson International, 2012, 4th Edition. 2. Randy Connolly, Ricardo Hoar, “Fundamentals of Web Development”, Pearson, 2015. 3. ISRD Group: Internet Technology and Web Design, Tata McGraw Hill Publishing Ltd, 2011			

MOOCs:

1. <https://www.mooc-list.com/course/programming-and-web-beginners-coursera>
2. <http://nptel.ac.in/courses/117105080/3>
3. <https://www.coursera.org/specializations/web-design>
4. <http://www.w3c.org>

Course Articulation matrix

[illegible]

Course Title	RESEARCH METHODOLOGY AND INTELLECTUAL PROPERTY RIGHTS		
Course Code	21RMIP	LTPC	(2-2-0)Audit
CIE	100 marks	Hours / Week	4
SEE	--	Total hours	28
Course objective: Understand research methodology, design, data collection, and analysis techniques and gain knowledge of Intellectual Property Rights (IPR) with a focus on patents, designs, trademarks, and copyrights, including their registration and protection procedures.			
Course Outcomes (COs) Upon completion of the course, students shall be able to:			
#	Statement	Mapping to POs	Mapping to PSOs
1.	Acquire research skills and conduct comprehensive literature reviews	8,10, 12	-
2.	Apply research design knowledge to create prototype	3,4, 8, 10, 12	-
3.	Evaluate methods for data collection, analysis, and sampling design	4, 8, 10, 12	-
4.	Understand global and Indian patent scenarios, as well as registration requirements, infringements and protections related to trademarks, copyrights, and designs	6,8, 10, 12	-
Course Contents:			
MODULE - I			7 Hrs.
Research Methodology: Introduction, Meaning of Research, Objectives of Research, Types of Research, Ethics in Research, Types of Research Misconduct. Literature Review and Technical Reading. Citations: Functions and Attributes, Impact of Title and Keywords on Citations, Knowledge flow through Citations, Acknowledgments.			
MODULE - II			7 Hrs.
Research Design: Need for Research Design, Important Concepts Related to Research Design: Dependent and Independent Variables, Extraneous Variable, Variable, Common Control, Confounded Relationship, Research Hypothesis. Experimental Designs: Introduction to Randomized Block Design, Complete Randomized Design, Latin Square Design, and Factorial Design.			
MODULE - III			7 Hrs.
Method of Data Collection: Primary and Secondary Data Collection. Sampling Design: Sampling fundamentals, Measurement, and Scaling Techniques, Criteria of Selecting a Sampling Procedure, Characteristics of a Good Sample Design, and Types of Sample Design. Data Analysis: Testing of Hypotheses: Null Hypothesis, Alternative Hypothesis, Type I and Type II Errors. Procedure for Hypothesis Testing: Mean, Variance, and Chi-square Test.			
MODULE - IV			7 Hrs.

Introduction to IPR: Different forms of IPR, Role of IPR in Research and Development. Patents: Principles Underlying Patent Law, Types of Patent Applications in India, Procedure for Obtaining a Patent. Design: What is a Design? Essential Requirements for a Registrable Design, Procedure of Registration of a Design. Trademarks: Essentials of a Trademark, Registration, and Protection of Trademarks, Rights Conferred by Registration of Trademarks, Infringements. Copyrights: Characteristics of Copyrights, Rights Conferred by Registration of Copyrights, Registration of Copyrights, Infringements, Remedies against Infringement of Copyrights.
Activity Components ➤ Students select a research topic and perform a literature review, identifying existing knowledge, synthesizing prior art, and compiling relevant citations leading to publishing a survey paper. ➤ Students develop research proposals, including the formulation of research hypotheses. ➤ Students collect primary or secondary data, design a sampling procedure, and perform data analysis using statistical techniques. ➤ Students analyze real-world case study/studies for legal issues and propose solution/s to infringement cases. <i>the rubrics for evaluation will be set suitably as decided by the BOS and will be announced to the students at the beginning of the semester.</i>
Text Book 1. Kothari C R. Research methodology: Methods and techniques. New Age International; 2004. 2. Pandey N, Dharni K. Intellectual property rights. PHI Learning Pvt. Ltd.; 2014 Jul 30. 3. Deb D, Dey R, Balas V E. Engineering research methodology. A Practical Insight for Researchers. 2019;153.
Reference Book: Thiel D V. Research methods for engineers. Cambridge University Press; 2014 Sep 11.

MAIN PROJECT PHASE - II					
Course Code	21CS801	L-T-P-C	(0-0-8) 4		
Exam Hrs.	3	Hours / Week	8		
SEE	50 Marks	Total Hours	-		
Course Objective: Design and implement solution for the identified real world problem in Phase I. Course Outcomes (COs): Upon completion of course the students will be able to					
#	Course Outcomes	Mapping to POs	Mapping to PSOs		
1.	Implement the design with appropriate techniques, resources and contemporary tools	3,5	1,2		
2.	Communicate effectively with team members and mentors, make presentations and prepare technical document	9,10,11,12	2		
3.	Use ethical practices in all endeavors	8	-		
4.	Share the responsibilities for carrying out the project & playing individual roles appropriately	9	-		
5.	Implement the design with appropriate techniques, resources and contemporary tools	3,5	1,2		
The project teams will implement the project started in their seventh semester					
The project work is to be evaluated in three stages: Stage I (30M) - First internal evaluation shall be taken up during this phase. This includes presentation on fine tuning of SRS & Design carried out in seventh semester. Stage II (20 M) – Mid phase evaluation shall be taken up during this phase. This includes presentation, intermediate project demonstration, draft copy of the paper Stage III (50 M) – Final project Demo, report submission and details of technical paper publication. The evaluation of the project stages shall be carried out by the evaluation committee comprising of project guide & other faculty members. The committee will be constituted by the project coordinator in consultation with the Head of the department. For Multidisciplinary projects guides will be allotted from each concerned branch.					
Rubrics for Evaluation of project					
Stage I (Project Progress):					
Evaluation of project phase II is carried out by evaluation committee.					
Sl. No.	Performance Indicators	Needs Improvement (0-2 marks)	Average (4-6 marks)	Good (7-10 marks)	Max marks
1.	System design and development	System specification is not identified.	System specification is identified but not satisfactory.	System specification is identified correctly.	10

2.	Identification of appropriate tool for application	Application tools are not identified.	Application tools identified but not used.	Application tools identified and used.	10
3.	Oral presentation	Entire contents not delivered.	Contents not delivered clearly.	Contents delivered clearly with confidence.	10
Total					30

Stage II (Mid Phase Project Demonstration with Draft paper):

Evaluation of this phase is done by evaluation committee.

Sl. No.	Performance Indicator	Needs Improvement (0-1 marks)	Average (2-3 marks)	Good (4-5 marks)	Total marks allocated
1.	Design and Implementation	Design not complete	Design partially completed	Design completed	5
2.	Demonstration	Incomplete.	Complete but not satisfactory.	Complete and satisfactory	5
3.	Technical paper Draft	Organization and technical content not relevant	Organization and technical content of paper complete but needs improvement	Organization and technical content of report are complete and satisfactory	5
4.	Oral presentation	Presentation slides are not clear.	Presentation slides are clear, but not satisfactory.	Presentation slides are clear and satisfactory.	5
Total					20

Stage III (Final Project Demonstration):

Evaluation of this phase is done by evaluation committee.

Sl. No.	Performance Indicator	Needs Improvement	Average	Good	Total marks allocated
1.	Final project demonstration	Project incomplete (4)	Project complete but needs improvement in interface design/ functionality, etc. (7)	Project completed (10)	10
2.	Oral Presentation	Disorganized and ineffective presentation (4)	Organized, but ineffective presentation (7)	Effective organized presentation (10)	10

3.	Report submission	Disorganized and contents are not sufficient (10)	Organized but not good content wise (16)	Effectively organized and well framed contents (20)	20
4.	Technical paper publication	Paper submitted for National Conference (8)	Paper submitted / published in an International Conference (9)	Paper submitted / published in a Journal (10)	10
Total					50

Course Articulation matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	-	-	-	2	2	-	-	-	-	-	-	-
CO2	3	-	3	3	-	-	-	-	-	3	-	-	3	3
CO3	-	-	3	-	3	-	-	2	3	-	2	-	3	3
CO4	3	-	-	-	3	-	-	-	3	3	-	-	3	3
CO5	3	-	-	-	-	-	-	2	-	3	-	3	-	-

Course Title	RESEARCH / INDUSTRY INTERNSHIP - III			
Course Code	21INT3	L-T-P-C	(0-0-24)12	
Exam Hrs.	3	Hours / Week	-	
CIE	100 Marks	Total Hours	-	
Course Objective: To gain the perspective of work environment in Research organization/Industry.				
Course Outcomes (COs): Upon completion of the course, students shall be able to:				
#	Course Outcomes	Mapping to POs	Mapping to PSOs	
1.	Apply the domain knowledge in solving the real world problems.	1,2	1,2	
2.	Work as a team member towards the chosen problem	9	1,2	
3.	Work with industry professionals and practice ethics in work environment.	8, 10,12	1,2	
4.	Document, publish and present the work carried out.	9,10,11,12	1,2	
Guideline: Students shall undergo In-house/ Research organization/Industry internship for a duration of one semester. At the end of the semester internal evaluation will be conducted for 100 marks according to the following rubrics.				
Rubrics:				
Criteria	Excellent	Good	Average	Poor
Ability to apply domain knowledge (20M)	Apply domain knowledge for design and development of all issues (20M)	Apply domain knowledge for design and development of most issues (15M)	Apply domain knowledge for design and development of specific issues (10M)	Unable to apply complete domain knowledge for design and development issues (5M)
Ability to develop / implement the solutions with appropriate techniques, resources and contemporary tools (20M)	Able to develop/implement all the solutions with appropriate techniques, resources and contemporary tools (20M)	Able to develop/ implement most of the solutions with appropriate techniques, resources and contemporary tools (15M)	Able to develop/implement specific solutions with appropriate techniques, resources and contemporary tools (10M)	Not confident to develop/implement solutions with appropriate techniques, resources and contemporary tools (5M)
Ability to work independently and in collaboration / multidisciplinary environment.	Able to work independently and in collaboration/ multidisciplinary environment. (20M)	Able to work independently with minimal guidance and in collaboration/ multidisciplinary environment. (15M)	Able to work independently with more guidance and in collaboration/ multidisciplinary environment. (10M)	Unable to work independently without guide support and in collaboration/ multidisciplinary environment. (5M)

(20M)				
Ability to allocate time effectively and manage to complete the work allotted within appropriate time. (15M)	Able to allocate time effectively and complete all the work allotted within appropriate time. (15M)	Able to allocate time effectively and complete most of the work allotted within appropriate time. (10M)	Able to allocate time effectively and manage to complete the work allotted (5M)	Unable to use time effectively and complete the work allotted.(3M)
Ability to exhibit integrity and ethical behaviour while carrying out the internship and for the preparation of internship report. (15M)	Able to effectively exhibit integrity and ethical behaviour while carrying out the internship and for the preparation of internship report. (15M)	Able to moderately exhibit integrity and ethical behaviour while carrying out the internship and for the preparation of internship report. (10M)	Able to partially exhibit integrity and ethical behaviour while carrying out the internship and for the preparation of internship report. (6M)	Unable to exhibit integrity and ethical behaviour while carrying out the internship and for the preparation of internship report. (3M)
Ability to demonstrate effective oral and written communication skills (10M)	Able to demonstrate effective oral and written communication skills (10M)	Able to demonstrate oral and written communication skills moderately. (7M)	Able to demonstrate oral and written communication skills minimally. (5M)	Unable to demonstrate effective verbal and written communication skills (2M)

Course Articulation matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	-	-	-	-	-	-	-	-	-	-	3	2
CO2	-	-	-	-	-	-	-	-	3	-	-	-	3	2
CO3	-	-	-	-	-	-	-	3	-	3	-	3	3	2
CO4	-	-	-	-	-	-	-	-	3	3	3	3	3	2