B.TECH (CSE) SYLLABUS

[W.E.F. 2019 – 2020]

A four year fulltime semester based degree programme in
Computer Science and Engineering

Department of Computer Science & Engineering
Aliah University
II A/27, New Town
Kolkata – 700156, West Bengal, India.

B.Tech (CSE) Program Outcome (PO)

After completion ofB.Tech (CSE) Program, a student should be able to:

PO1: Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2: 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..

PO3: 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

PO4: 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

PO5: 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.

PO6: 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.

PO7: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development

PO8: Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9: Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10: 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.

PO11: 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.

PO12: 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.

The Program Specific outcome (PSOs):

Upon successful completion of B.Tech(CSE) Program, student will be able to:

PSO1: Apply the knowledge and skills of Computer Science and Engineering for solving real life problems

PSO2: Design, develop, test, and maintenance of software systems based on requirements

PSO3: Pursue higher education including research by applying the knowledge of Computer Science and Engineering

PSO4: Adapt to changing technical, organizational, and societal needs with ability to work and communicate effectively as a team member or leader

Semester I:

Engineering Mechanics

Code: MENUGES01
Contracts:3L+1T
Credits:4
This is the foundation course that will help to understand the advanced courses in the subsequent semesters. A working knowledge of statics using force equilibrium and free body diagrams. It provides an understanding of deformation and how to determine them in a wide range of simple, practical structural problems, and an understanding of the mechanical behaviour of materials under various load conditions.

Couse Outcomes:

CO 1: Apply vector algebra and principles of statics to analyze force systems, including equilibrium, free-body diagrams, and force-couple systems.
CO 2: Understand the concepts of friction, centroid, center of gravity, and moment of inertia to analyze the static equilibrium of structures and bodies.
CO 3: Apply the principles of virtual work, simple stresses, strains, and fluid statics to solve practical engineering problems.
CO 4: Analyze kinematics and kinetics of particles, including rectilinear and curvilinear motion, using Newton's laws of motion and graphical methods.
CO 5: Utilize principles of work, energy, impulse, momentum, and dynamics of particles for solving engineering problems involving vibrations, power, and efficiency.

CO – PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12
CO1	3	3	2	2								
CO2	3	2	3	1								
CO3	2	3	2	2								
CO4	3	3	2	2								
CO5	3	2	3	3	1							

Module no	Content of the module	Allotted hour
1	Importance of Mechanics in engineering. Introduction to Statics; Concept of Particle and Rigid Body; Types of forces: collinear, concurrent, parallel, concentrated, distributed; Vector and scalar quantities; Force as a vector; Transmissibility of a force.	3
	Introduction to Vector Algebra; Parallelogram law; Lami's theorem; Co-ordinate representation of vector; Cross product and Dot product and their applications.	3
	Two dimensional force system; Resolution of forces; Moment; Varignon's theorem; Couple; Resolution of a coplanar force by its	4

	equivalent force-couple system; Resultant of forces	
2	Concept and Equilibrium of forces; Free body concept and diagram; Equations of equilibrium, plane frames and trusses.	**4**
	Concept of Friction; Coulomb friction; Angle of Repose; Coefficient of friction	**4**
3	Distributed Force: Centroid and Centre of Gravity; Centroids, circular sector, quadrilateral, composite areas consisting of different figures.	**4**
	Moments of inertia: Parallel axis theorem; Perpendicular axis theorem; Mass moment of inertia of symmetrical bodies e.g. cylinder, sphere, cone etc.	**4**
	Concept of virtual work and energy; Concept of simple stresses and strains; Torsion; Concept of fluid statics	**4**
4	Introduction to Dynamics: Kinematics and Kinetics; Newton's laws of motion; Law of gravitation & acceleration due to gravity; Rectilinear motion of particles; determination of position, velocity and acceleration under uniform and non-uniformly accelerated rectilinear motion; construction of x-t, v-t and a-t graphs.	**4**
	Plane curvilinear motion of particles: Rectangular components (Projectile motion); Normal and tangential components (circular motion). Relative motion.	**4**
5	Kinetics of particles: Newton's second law; Equation of motion; D'Alembert's principle and free body diagram; Principle of work and energy; Principle of conservation of energy; Power and efficiency; Impulse and Momentum.	**6**
	Steady flow; Vibration	**2**

Upon completion of this course, students will able to grasp the following concepts –

- Use scalar and vector analytical techniques for analyzing forces in statically determinate structures.
- Apply fundamental concepts of kinematics and kinetics of particles to the analysis of simple, practical problems.
- Understand basic kinematics concepts – displacement, velocity and acceleration (and their angular counterparts);
- Understand basic dynamics concepts – force, momentum, work and energy;
- Understand and be able to apply Newton's laws of motion;
- Understand and be able to apply other basic dynamics concepts – the Work-Energy principle, Impulse – Momentum principle and the coefficient of restitution;
- Learn to solve dynamics problems choosing an appropriate solution strategy;
- Attain an introduction to basic machine parts such as pulleys and mass-spring systems etc.

Suggested Books:

1. Meriam &Kraige: "Engineering Mechanics [Vol I & II]",Wiley India.
2. R.C. Hibbeler: "Engineering Mechanics: Statics &Dynamics",Pearson.
3. F. P. Beer and E. R. Johnston: "C++: Vector Mechanics for Engineers [Vol I & II]", TMH.
4. Timoshenko, Young and Rao: "Engineering Mechanics",TMH.

Basic Electrical Engineering (ECE & EEN)

Code: EENUGES01
Contracts: 3L
Credits: 3

Couse Outcomes:

CO 1: Understand the basic concepts of electrostatics, electromagnetism, and electrical circuits.
CO 2: Apply DC circuit analysis techniques, including node analysis, loop analysis, and network theorems.
CO 3: Analyze AC circuits, including single-phase, three-phase circuits, and resonant circuits.
CO 4: Understand the operation, efficiency, and regulation of transformers and DC machines.
CO 5: Understand the basic principles of power systems and induction motors.

CO – PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12
CO1	3	2										
CO2	3	3	2		2							
CO3	2	3	3	2	2			2				
CO4	3	2	2	3	3	2		2				
CO5	2	2	2	2		3	3	2				

Unit	Content	Contact hrs
Unit I	Introduction: Basic concepts of Electrostatics and Electromagnetic	4
Unit II	DC Circuit: Introduction of Electric Circuit & Elements, Loop Analysis, Node analysis, Star (Y) - Delta (Δ) & Delta (Δ)-Star (Y) Transformations.	6
Unit III	DC Network Theorem: Superposition Theorem, Thevenin's theorem, Norton's theorems, Maximum Power Transfer Theorem, Reciprocity Theorem, Time-domain analysis of first-order RL and RC circuits.	8
Unit IV	Single-phase AC Circuits Generation of Sinusoidal Voltage Waveform (AC) and Some Fundamental Concepts, Representation of Sinusoidal Signal by a Phasor, Analysis of single-phase ac circuits consisting of R, L, C, RL, RC, RLC combinations (series and parallel), resonance. Three phase balanced circuits, voltage and current relations in star and delta connections	8
Unit V	Transformer: Definition, working principle & construction, EMF equation, Equivalent circuit, Open circuit & Short	4

	circuit tests, Efficiency & Regulation	
Unit VI	DC Machines: Constructional Features of D.C Machines, Principle of Operation of D.C Machines, EMF & Torque Equation, D.C Generators, D.C Motors, Losses, Efficiency, 3-point Starter and speed control of DC shunt Motor.	4
Unit VII	Three-phase Induction Motor: Introduction to 3-phase induction motor	1
Unit VIII	Introduction to Power System: Basic concepts of Power System	1

Suggested Readings:

1. D.P. Kothari & I.J. Nagrath, "Basic Electrical Engineering", TMH.
2. Hughes, "Electrical and Electronics Technology", Pearson Education.
3. V.N. Mittle & Arvind Mittal, "Basic Electrical Engineering", TMH, Second Edition.
4. V. D. Toro, "Electrical Engineering Fundamentals", Prentice Hall India,
5. C L Wadhwa, "Basic Electrical Engineering", New Age International Publishers.

Basic Electronics Engineering

Code: ECEUGES01
Contracts: 3L
Credits: 3

Couse Outcomes:

CO 1: Understand the fundamental principles of semiconductors, including intrinsic and extrinsic types, drift and diffusion of charge carriers, and the impact of doping on electrical conductivity.
CO 2: Analyze the characteristics of P-N junction diodes, rectifiers, Zener diodes, and design rectification circuits using clippers and clampers.
CO 3: Understand the operation and configurations of bipolar junction transistors (BJTs) and field-effect transistors (FETs) for small-signal analysis, amplification, and biasing techniques.
CO 4: Apply the concepts of feedback in amplifiers to improve gain, stability, and bandwidth in electronic circuits.
CO 5: Utilize operational amplifiers for various applications such as summing amplifiers, voltage followers, integrators, and differentiators, and understand the working of electronic instruments like the CRO.

CO – PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12
CO1	3	2										
CO2	3	3	2	1								
CO3	3	2	3	2								
CO4	2	2	3	2	1							
CO5	3	3	2	3					1			

Module No.	Content	Lecture
1	**Semiconductor Basics:** Energy band theory, Fermi levels, Conductors, Semiconductors and Insulators: electrical properties, Semiconductors: intrinsic and extrinsic, P-type and N-type semiconductors; electrical conduction phenomenon, drift and diffusion carriers, mass action law.	7
2	**Rectifying Devices:** Formation of P-N junction, formation of depletion zone, Junction capacitance-I characteristics, Zener breakdown, Avalanche breakdown. Linear piecewise model; rectifiers: half wave, full wave, ripple factor, efficiency, Clipper and Clamper circuits	6
3	**Transistors:** Formation of PNP / NPN junctions, principle of operation, configurations, transistor characteristics. Biasing and Bias stability: small signal low frequency operation of transistors; equivalent circuits h parameters, Transistors as amplifier: voltage gain, current gain, input impedance and output impedance, Decibel power.	7
4	**Field Effect Transistor:** Construction and characteristics of JFET and MOSFET characteristics; depletion and enhancement type, FET small signal model.	4
5	**Feed Back Amplifier:** Block diagram, properties, positive and negative feedback, loopgain,topologies of feedback amplifier; effect of feedback on gain,output impedance, input impedance, sensitivities(qualitative),bandwidth stability	4
6	**Operational Amplifier:** Introduction to integrated circuits, operational amplifier and its terminal properties; concept of virtual earth, Gain-frequency and Slew rate; inverting and non-inverting mode of operation, voltage summing, difference, voltage follower, integrator, and differentiator.	4

7	**Electronic Instruments:** Principle of operation of CRO; Electron ballistics and electron beam deflection; Concept of time base; Measurement of voltage, and frequency.	**4**

Suggested Books:

1. Rakshit & Chattopadhyay, Foundation of Electronics, New Age.
2. Cathey, Electronic Devices and Circuits, Shaum series, TMH
3. Boylestead & Nashlesky, Electronic Devices and Circuits, Pearson
4. Millman and Halkias, Integrated Electronics, TMH

Engineering Mathematics I

Code: MATUGBS01
Contracts: 4L
Credits: 4

Couse Outcomes:

CO 1: Understand the fundamental concepts of sequences, series, and power series, and analyze their convergence.
CO 2: Apply differentiation techniques, mean value theorems, Taylor and Maclaurin series, and L'Hospital's rule to solve real-world problems involving maxima, minima, and limits.
CO 3: Use reduction formulae, and evaluate Beta and Gamma functions in solving integral-related problems.
CO 4: Analyze geometric properties using lines, planes, polar coordinates, and quadric surfaces, and compute volume, area, and arc lengths.
CO 5: Apply vector calculus to study the continuity, differentiability, and curvature of vector functions, as well as evaluate multiple integrals and transformations using Jacobians.
CO 6: Apply Green's, Gauss's, and Stokes' theorems to solve practical problems involving line, surface, and volume integrals.

CO – PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12
CO1	**3**	**2**										
CO2	**3**	**3**	**2**									
CO3	**3**	**2**	**1**									
CO4	**3**	**2**	**2**									
CO5	**3**	**3**	**2**	**2**								
CO6	**3**	**3**	**3**	**2**								

Module	Content	Lecture
1	Basics of sequence and series ; Power series, Limit, Continuity.	**14**

2	Differentiation, Mean value theorems and its application; Taylor'stheorem, Maclaurin's infinite series; Maxima and minima; L Hospital's rule.	**12**
3	Reduction formulae, Beta and Gama functions.	**2**
4	Lines and planes, Polar coordinates, Quadric surfaces, Volume,Area, length.	**10**
5	Continuity, Differentiability of vector functions, Arc length; Curvature, Torsion, Serret-Frenet formulas, Double, triple integrals, Jacobian .	**10**
6	Green theorem, Gauss theorem and Stokes Theorems and its application.	**6**

Suggested Books:

1. Advanced Engineering Mathematics : Erwin Kreyszig
2. Advanced Engineering Mathematics : R.K. Jain & S. R. K lyengar
3. Advanced Engineering Mathematics : C. R. Wylle & L. C. Barrett
4. Differential & Integral Calculus : N. Plskunov

Engineering Physics

Code: PHYUGBS01
Contracts: 3L
Credits: 3

Couse Outcomes:

CO 1: Understand and analyze fundamental concepts of mechanics, quantum mechanics, and statistical mechanics, including principles like Bernoulli's theorem, Schrodinger equation, and statistical distributions.
CO 2: Apply principles of optics, such as interference, diffraction, and polarization, in solving practical problems, including laser technology and optical fibers.
CO 3: Demonstrate knowledge of electrostatics, electricity, and magnetism, and their applications in electric circuits, transformers, and AC/DC analysis.
CO 4: Explain the crystalline structure of solids, X-ray diffraction, and the basics of semiconductor physics and superconductivity.
CO 5: Analyze nuclear phenomena, including radioactivity, nuclear reactions, and their applications in nuclear reactors and radioactive dating.

CO – PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12
CO1	**3**	**3**	**2**	**2**								**1**
CO2	**3**	**2**	**2**	**2**						**2**		
CO3	**3**	**3**	**3**	**2**								**1**
CO4	**3**	**2**		**1**								
CO5	**3**	**3**		**2**						**2**		**1**

Module No.	Content	Lecture
1	**Mechanics** **Classical mechanics:** scalars and vectors, vector multiplication, central force, mechanics of system of particles, elastic properties, rotational motion, fluid dynamics: viscocity, Stoke's law, streamline flow, equation of continuity, Reynold's number, Bernoulli's theorem **Quantum mechanics:** Photoelectric effect, de-Broglie's hypothesis, matter wave, Hysenberg's uncertainty principle, wave function,Schrodinger equation and simple problems **Statistical mechanics:** Necessity of statistical mechanics, Maxwell- Boltzman, Bose-Einstein and Fermi-Dirac distribution formula	12
2	**Optics** Huygen's principle, Interference of light, Young's double-slit experiment, Newton's ring; Diffraction: Fresnel and Fraunhofer class, Fresnel's half-period zones, zone plate, Fraunhofer diffraction due to single slit and plane transmission grating (elementary theory); Polarization: plane, circular and elliptically polarized light, Brewster's law, Polaroid, optical activity. Coherence length and time; Einstein's A and B coefficients; spontaneous and induced emissions, condition for laser action, population inversion, He-Ne laser Optical Fiber, core and cladding; total internal reflection; optical fiber and waveguide; communication through optical fiber, energy loss, attenuation and dispersion	6
3	**Electrostatics & Electricity** Coulomb's law, intensity and potential of point charge, Gauss's theorem and simple applications, electric-dipole, Electric displacement, capacitor, parallel plates and cylindrical, Thermoelectricity, Magnetic effects of currents, Self-inductance, Mutual inductance, Transformer Electric circuit elements and AC, DC circuit analysis.	6
4	**Solid State Physics** Crystalline nature of solid, diffraction of X-ray, Bragg's law, Mosley'slaw, explanation from Bohr's theory, Origin of the energy gap, bandtheory; metal, semiconductor and insulators; intrinsic and extrinsicsemiconductors, dia, para and ferro magnetic materials, superconductivity	6

5	**Nuclear Physics** Binding energy of nucleus, Binding energy curve and stability, Radioactivity, successive disintegration, radioactive equilibrium, radioactive dating, radioisotope and their uses, Nuclear transmutation, fission & fusion, nuclear reactor	**6**

Suggested Books:

1. Wiley precise Text, Engineering Physics, Wiley India Private Ltd., New Delhi. Book series –2014,
2. S.O.Pillai, Solid State Physics, New Age International. Sixth Edition.
3. Chintoo S Kumar ,K Takayana and K P J Reddy, Shock waves made simple, Willey India Pvt. Ltd. New Delhi,2014
4. A Marikani, Engineering Physics, PHI Learning Private Limited, Delhi - 2013
5. Prof. S. P. Basavaraju, Engineering Physics, Subhas Stores, Bangalore – 2
6. V Rajendran ,Engineering Physics, Tata Mc.Graw Hill Company Ltd., New Delhi - 2012
7. S Mani Naidu, Engineering Physics, Pearson India Limited – 2014

Elementary Arabic and Islamic Studies

Code: UCCUGAU01
Contracts: 4L
Credits: 0

Engineering Graphics & Design

Code: CENUGES01
Contracts: 1T+3P
Credits: 2.5

Couse Outcomes:

CO 1: Understand the basic principles of electrical circuits, electrostatics, and electromagnetics.

CO 2: Apply fundamental techniques like loop and node analysis, and transformations in solving DC circuits.

CO 3: Analyze DC networks using various theorems like Thevenin's, Norton's, Superposition, and Maximum Power Transfer.

CO 4: Comprehend AC circuit analysis involving single-phase and three-phase systems, resonance, and phasor representation.

CO 5: Understand the working principles of transformers, DC machines, and induction motors, along with an introduction to power systems.

CO – PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12
CO1	3	2										1
CO2	3	3	2									
CO3	3	3	3	2						1		1
CO4	3	2	2	2								
CO5	3	2		1						1		2

Module no	Content of the module	Allotted hour
1	**Introduction:** Basic concepts of Electrostatics and Electromagnetic.	4
2	**DC Circuit**: Introduction of Electric Circuit & Elements, Loop Analysis, Node analysis, Star (Y) - Delta (Δ) & Delta (Δ)-Star (Y) Transformations.	6
3	**DC Network Theorem**: Superposition Theorem, Thevenin's theorem, Norton's theorems, Maximum Power Transfer Theorem, Reciprocity Theorem, Time-domain analysis of first-order RL and RC circuits.	8
4	**Single-phase AC Circuits** Generation of Sinusoidal Voltage Waveform (AC) and Some Fundamental Concepts, Representation of Sinusoidal Signal by a Phasor, Analysis of single-phase ac circuits consisting of R, L, C, RL, RC, RLC combinations (series and parallel), resonance. Three phase balanced circuits, voltage and current relations in star and delta connections.	8
5	**Transformer:** Definition, working principle & construction, EMF equation, Equivalent circuit, Open circuit & Short circuit tests, Efficiency & Regulation.	4
6	**DC Machines**: Constructional Features of D.C Machines , Principle of Operation of D.C Machines, EMF & Torque Equation , D.C Generators, D.C Motors, Losses, Efficiency, 3-point Starter and speed control of DC shunt Motor.	4
7	**Three-phase Induction Motor**: Introduction to 3-phase induction motor	1
8	**Introduction to Power System:** Basic concepts of Power System	1

Suggested Books:

1. D.P. Kothari & I.J. Nagrath: "Basic Electrical Engineering", TMH.
2. Hughes: "Electrical and Electronics Technology", Pearson Education.
3. V.N Mittle& Arvind Mittal: "Basic Electrical Engineering", TMH[Second Edition].
4. V. D. Toro: "Electrical Engineering Fundamentals", Prentice Hall India.
5. C L Wadhwa: "Basic Electrical Engineering", New Age International Publishers.

Basic Electrical Engineering Lab

Code: EENUGES02
Contracts: 3P
Credits: 1.5

Couse Outcomes:

CO 1: Apply fundamental circuit theorems (Thevenin's, Norton's, Superposition, Maximum Power Transfer) to analyze electrical circuits.
CO 2: Demonstrate the working and characteristics of electrical lighting systems like fluorescent and incandescent lamps.
CO 3: Analyze and perform speed control methods for DC motors and understand starting and reversing mechanisms.
CO 4: Conduct tests on single-phase transformers to evaluate their open-circuit and short-circuit performance.
CO 5: Perform calibration of electrical instruments and assess R-L-C circuit characteristics and resistance measurements using testing equipment.

CO – PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12
CO1	3	3	2	2						1		
CO2	2	2	1									
CO3	3	2	3			1			2	1		1
CO4	3	3		2								
CO5	3	2	2		1	1				2		

List of experiments:

1. Verification of Thevenin's Theorem
2. Verification of Norton's Theorem
3. Verification of Superposition Theorem
4. Verification of Maximum Power Transfer theorem
5. Power Measurement of Fluorescent Lamp
6. V-I characteristics of Incandescent Lamp
7. Speed Control of DC motor Using Field and Armature Control Method
8. Starting and reversing of DC motor
9. Open circuit and Short circuit test of Single Phase Transformer
10. Calibration of Voltmeter and Ammeter
11. Characteristics of Series R-L-C Circuit

12. Characteristics of Parallel R-L-C Circuit
13. Resistance measurement and continuity test of DC motor using Megger

Reference Books:

1. **D.P. Kothari & I.J. Nagrath** - *Basic Electrical Engineering*, TMH
2. **V.N. Mittal & Arvind Mittal** - *Basic Electrical Engineering*, TMH (Second Edition)
3. **C.L. Wadhwa** - *Basic Electrical Engineering*, New Age International Publishers
4. **Hughes, E.** - *Electrical and Electronics Technology*, Pearson Education

Basic Electronics Engineering Lab

Code: ECEUGES02
Contracts: 3P
Credits: 1.5

Couse Outcomes:

CO 1: Identify and familiarize themselves with various electrical and electronic components and measurement instruments.
CO 2: Analyze and interpret the characteristics of semiconductor diodes and their applications in circuits like clipping and clamping.
CO 3: Investigate and characterize the behavior of Bipolar Junction Transistors (BJT) and Field Effect Transistors (FET).
CO 4: Understand the operational characteristics of Operational Amplifiers (OP-AMP) and evaluate parameters like slew rate and bandwidth.
CO 5: Apply practical skills to design and test electronic circuits, enhancing hands-on experience with real-world electronic systems.

CO – PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12
CO1	3				2					2		
CO2	3	2	2	2						1		
CO3	3	3	2		2					1		
CO4	3	2	2		1					1		1
CO5	3	3	2	3	3	2			2	2	2	2

Module No.	Content	Lecture
1	Familiarization of Electrical and Electronics Components	3
2	Familiarization of Various Instruments like Power Supply, Digital Multimeter, Function	3
3	Generator, CRO etc.	3
4	Study of Junction Diode Characteristics	3
5	Study of Zener Diode Characteristics	3

6	Study of Clipping Circuits	**3**
7	Study of Clamping Circuits	**3**
8	Study of Rectifier Circuits	**3**
9	Study of BJT Characteristics	**3**
10	Study of FET Characteristics	**3**
11	Study of fundamental characteristics of OP-AMP	**3**
12	Determination of Slew rate and bandwidth of an OP-AMP.	**3**

Reference Books:

1. **Boylestad, R. L., & Nashelsky, L.** - *Electronic Devices and Circuit Theory*, Pearson Education.
2. **Sedra, A. S., & Smith, K. C.** - *Microelectronic Circuits*, Oxford University Press.
3. **Bell, D. A.** - *Laboratory Manual for Electronic Devices and Circuits*, Oxford University Press.
4. **Hughes, E.** - *Electrical and Electronic Technology*, Pearson Education.
5. **Floyd, T. L.** - *Electronic Devices (Conventional Current Version)*, Pearson Education.

Engineering Physics Lab

Code: PHYUGBS02
Contracts: 3P
Credits: 1.5

Couse Outcomes:

CO 1: Gain proficiency in measuring basic physical quantities using precision instruments like Vernier caliper, screw gauge, and spherometer.
CO 2: Understand and apply principles of optics, magnetism, and mechanics through experiments like focal length determination and Young's modulus measurement.
CO 3: Develop skills to determine material properties such as moment of inertia, rigidity modulus, and Young's modulus.
CO 4: Enhance experimental techniques for measuring physical quantities related to mechanics, electricity, and magnetism.
CO 5: Learn the application of practical tools to measure unknown values (e.g., resistance, frequency, magnetic field strength)

CO – PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12
CO1	**3**	**2**		**1**								
CO2	**3**	**2**										
CO3	**3**	**3**	**21**									
CO4		**3**		**2**								
CO5	**2**			**3**					**3**	**2**		

List of experiments:

1. Measurements of length (or diameter) using vernier scale, slide caliper, screw gauge and travelling microscope.
2. Determination of the radius of curvature of a spherical surface by using spherometer.
3. Determination of moment of inertia of (a) a cylinder and (b) a rectangular solid bar.
4. To determine the focal length of a concave lens by combination method and hence to determine the refractive index of the material of the lens by measuring the radii of curvature of both lenses
5. Determination of the average resistance per unit length of the meter bridge wire by Carey-Foster's method and hence to determine an unknown resistance
6. Determination of the horizontal component of the earth's magnetic field and the magnetic moment of a magnet by employing magnetometers
7. Determination of Young's Modulus of elasticity of a material of a bar by the method of flexure.
8. Determination of rigidity modulus of a material of a wire by static method.
9. Determination of rigidity modulus of a material of a wire by dynamic method.
10. Determination of unknown frequency of a tuning fork by using a sonometer

Reference Books

1. **S Mani Naidu** - *Engineering Physics*, Pearson India Limited
2. **V Rajendran** - *Engineering Physics*, Tata McGraw-Hill Education
3. **B. K. Agarwal & H. B. Dwivedi** - *Practical Physics*, S. Chand & Co.
4. **S.O. Pillai** - *Solid State Physics*, New Age International

Semester II:

Programming for Problem Solving

Code: CSEUGES01
Contracts: 3L
Credits: 3
Course Outcomes:

CO 1: Understand the fundamentals of computing and problem-solving concepts, including algorithms and flowcharts.
CO 2: Apply the basic constructs of the C programming language, such as data types, operators, and control statements, to develop simple programs.
CO 3: Implement input/output operations and handle console-based data efficiently.
CO 4: Utilize arrays and string manipulation techniques for data storage and processing.
CO 5: Demonstrate the use of functions and recursion to promote modular programming.
CO 6: Analyze the use of pointers, memory allocation, and pointer arithmetic for efficient data management.
CO 7: Work with structures, unions, enumerations, and preprocessor directives for data organization and compilation control.
CO 8: Employ file handling techniques to manage data storage, retrieval, and file I/O operations

CO – PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2										2
CO2	3	3	3		2							
CO3	3	2	2		3							
CO4	3	2	2		2							
CO5	3	3	3		3				2	2		2
CO6	3	3	2		3	3						
CO7	2	2	3		2			2			2	
CO8	3	2	3	2	3						2	2

Module no	Content of the module	Allotted hour
1	**Introduction to computing:** block architecture of a computer, bit, bytes, memory, and representation of numbers in memory.	1
2	**Introduction to problem solving:** Basic concepts of an algorithm, program design methods, flowcharts.[1]	1
3	**Introduction to C programming:** A Brief History of C, C is middle-level Language, is a Structured Language, Complier Vs Interpreters, The Form of a C Program, Library & Linking, Compilation & Execution process of C Program . [2]	2
4	**Variables, Data Types, Operator & Expression:** Character Set, Token, Identifier & Keyword, Constant, Integer, Floating Point,	3

	Character, String, Enumeration, Data Types in C, Data Declaration & Definition Operator & Expression, Arithmetic, Relational, Logical, Increment & Decrement, Bit wise, Assignment, Conditional, Precedence & Associability of Operators.	
5	**Console I/O:** Introduction, Character input & Output, String Input & Output, Formatted Input/Output (scanf/printf), sprintf&sscanf.	2
6	**Control Statement:** Introduction, Selection Statements, Nested if, if-else-if, The "?" Alternative, The Conditional Expression, switch, Nested switch, Iteration Statements, for loop, while loop, do-while loop, Jump Statements, Goto& label, break & continue, exit() function.	4
7	**Array & String:** Single Dimension Arrays, Accessing array elements, Initializing an array, Multidimensional Arrays, Initializing the arrays, Memory Representation, Accessing array elements, String Manipulation Functions, searching, sorting an array.	6
8	**Function:** Introduction, advantages of modular design, prototype declaration, Arguments & local variables, Returning Function Results by reference & Call by value, passing arrays to a function, Recursion.	4
9	**Storage Class & Scope:** Meaning of Terms, Scope - Block scope & file scope, Storage Classes Automatic Storage, Extern Storage, Static, Storage, Register Storage.	2
10	**Pointers:** Introduction, Memory Organization, The basics of Pointer, The Pointer operator Application of Pointer, Pointer Expression, Declaration of Pointer, Initializing Pointer, De-referencing Pointer,Void Pointer, Pointer Arithmetic, Precedence of &, * operators Pointer to Pointer, Constant Pointer, Dynamic memory allocation, passing pointer to a function, array of pointers, accessing arrays using pointers, handling strings using pointers.	4
11	**Structure, Union, Enumeration &typedef:** Structures, Declaration and Initializing Structure, Accessing Structure members, Structure, Assignments, Arrays of Structure, Passing, Structure to function, Structure Pointer, Unions.	2
12	**C Preprocessor:** Introduction, Preprocessor Directive, Macro Substitution, File Inclusion directive, Conditional Compilation.	2
13	**File handling:** Introduction, File Pointer, Defining & Opening a File, Closing a File, Input/Output Operations on Files, Operations on Text mode files and binary mode files, Error Handling During I/O Operation, Random Access To Files, Command Line Arguments	3

Suggested Books:

1. B.S. Gottfried: "Programming in C", TMH.
2. B.W. Kernighan and D.M. Ritchie: "The C Programming Language", PHI.
3. H. Schildt: C++: "The Complete Reference", TMH, 4e.
4. B. Stroustrup: "The C++ Programming Language", Addison-Wesley.
5. E. Balagurusamy: "Programming in ANSI C", TMH.
6. YashwantKanetkar: "Let Us C", BPB Publications.
7. K. N. King: "C Programming: A Modern Approach", W. W. Norton and Company.
8. PradipDey and Manas Ghosh: "Programming in C", Oxford University Press

Basic Electrical Engineering

Code: EENUGES01
Contracts: 3L
Credits: 3

Couse Outcomes:

CO 1: Understand the basic concepts of electrostatics, electromagnetics, and electrical circuits.
CO 2: Analyze and solve DC circuits using network theorems and transformations.
CO 3: Analyze single-phase AC circuits and understand resonance and three-phase circuits.
CO 4: Understand the operation and efficiency of transformers and DC machines.
CO 5: Introduce three-phase induction motors and basic power system concepts.

CO – PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12
CO1	3	2	1		2							
CO2	3	3	2	2		2						
CO3	2	3	3	2	1		2					
CO4	2	2	1	3	2	2		2	2			
CO5		1	1	2	3						2	

Module no	Content of the module	Allotted hour
1	**Introduction:** Basic concepts of Electrostatics and Electromagnetic.	4
2	**DC Circuit**: Introduction of Electric Circuit & Elements, Loop Analysis, Node analysis, Star (Y) - Delta (Δ) & Delta (Δ)-Star (Y) Transformations.	6
3	**DC Network Theorem**: Superposition Theorem, Thevenin's theorem, Norton's theorems, Maximum Power Transfer Theorem, Reciprocity Theorem, Time-domain analysis of first-order RL and RC circuits.	8
4	**Single-phase AC Circuits** Generation of Sinusoidal Voltage Waveform (AC) and Some Fundamental Concepts, Representation of Sinusoidal Signal by a Phasor, Analysis of single-phase ac circuits consisting of R, L, C, RL, RC, RLC combinations (series and parallel), resonance. Three phase balanced circuits, voltage and current relations in star and delta connections.	8
5	**Transformer:** Definition, working principle & construction, EMF equation, Equivalent circuit, Open circuit & Short circuit tests, Efficiency & Regulation.	4
6	**DC Machines**: Constructional Features of D.C Machines , Principle of Operation of D.C Machines, EMF & Torque Equation , D.C Generators, D.C Motors, Losses, Efficiency, 3-point Starter and speed control of DC shunt Motor.	4

7	**Three-phase Induction Motor**: Introduction to 3-phase induction motor	1
8	**Introduction to Power System:** Basic concepts of Power System	1

Suggested Books:

1. D.P. Kothari & I.J. Nagrath: "Basic Electrical Engineering", TMH.
2. Hughes: "Electrical and Electronics Technology", Pearson Education.
3. V.N Mittle& Arvind Mittal, "Basic Electrical Engineering", TMH [Second Edition].
4. V. D. Toro: "Electrical Engineering Fundamentals", Prentice Hall India.
5. C L Wadhwa: "Basic Electrical Engineering", New Age International Publishers.

Engineering Mathematics II

Code: MATUGBS02
Contracts: 4L
Credits: 4

Couse Outcomes:

CO 1: Understand matrix operations, determinants, and the concept of eigenvalues and eigenvectors.
CO 2: Analyze and solve complex equations and integrals, along with applying inequalities and the theory of equations.
CO 3: Solve first-order differential equations and understand their applications.
CO 4: Solve higher-order linear differential equations, including those with constant coefficients and variable coefficients.
CO 5: Analyze and solve systems of linear differential equations.

CO – PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12
CO1	3	3	2	2	1							
CO2	3	3	2	2		1						
CO3	2	3	3	2	2							
CO4	3	3	3	3	2	1		2	2			
CO5	3	2	3	3							2	

Module No.	Content	Lecture
1	Matrices: Matrix operations (Addition, Multiplication, Transpose), invertible matrix.	4
2	Determinant and their properties.	2

3	Row reduced echelon form; Rank of a matrix. Solution of the matrix equation Ax = b; Cramer's rule. Eigenvalues and eigenvectors, characteristic polynomial of a matrix, Cayley–Hamilton theorem and its application. Linear dependence and independence of vectors, basis and dimension. Complex numbers and Complex integrals. Inequalities, Theory of equations.	**32**
4	Complex numbers and Complex integrals. Inequalities, Theory ofequations.	**18**
5	Differential equation of first order and first degree: Exact, separable andhomogeneous differential equations, Bernoulli's equation, ODEs of first order but not of first degree; Clairaut's equation.	**7**
6	Higher order linear equation with constant coefficients: Complementaryfunction, Particular integral, Symbolic Operator D.	**4**
7	Method of undetermined coefficients, Euler's homogeneous equationand deduction to an equation of constant coefficients.	**4**
8	Second order linear equation with variable coefficients: exact equation: reduction of order; variation of parameters; reduction to normal form; change of independent variables. Simple eigen value problems.	**4**
9	System of linear differential equations with constant coefficients.	**2**

Suggested Books:

1. As Advanced Engineering Mathematics : Erwin Kreyszig
2. Advanced Engineering Mathematics : R.K. Jain & S. R. K lyengar
3. Advanced Engineering Mathematics : C. R. Wylle & L. C. Barrett
4. Differential & Integral Calculus : N. Plskunov

Engineering Chemistry

Code: CHMUGBS01
Contracts: 3L
Credits: 3

Couse Outcomes:

CO 1: Understand the fundamental concepts of thermodynamics and its application in chemical systems.
CO 2: Analyze the various impurities in water and understand the methods of water treatment for domestic purposes.
CO 3: Gain knowledge of polymers, their classification, polymerization techniques, and applications in various industries.
CO 4: Learn the principles of green chemistry and its applications in sustainable chemical processes.

CO – PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12
CO1	3	3	2	2	1							
CO2	3	2	2	2		1						
CO3	3	3	2	2	2							
CO4	3	2	3	2	2	1					2	

Module no	Content of the module	Allotted hour
1	**Thermodynamics:** Importance and scope, definitions of system and surroundings; type of systems; Extensive and intensive properties; Steady state and equilibrium; Zeroth law of thermodynamics; First law of thermodynamics, internal energy and Enthalpy as a state function; Second law of thermodynamics; Kelvin, Planck and Clausius statements; Carnot cycle and refrigerator; Carnot's theorem; Physical concept of entropy.	12
2	**Water and its treatment:** Sources of water, Impurities in water, Hardness of water, Determination of hardness of water, Water quality parameter, Treatment of water for domestic purpose, Waste water.	8
3	**Polymers:** Terminology, Classification of polymers, Polymerization techniques, Molecular weight of polymers, Plastics, Rubbers, Fibers, Conducting and semiconducting polymers, Natural polymers.	8
4	**Green Chemistry:** Definition and concept of green chemistry, Emergence of green chemistry, Alternative solvents, Design of safer chemicals, Microwave radiation of green synthesis, Green laboratory Technology.	8

Suggested Books:

1. K. S. Maheswaramma and M. Chugh: "Engineering Chemsitry"; Pearson, 2016.
2. Wiley: "Engineering Chemistry", Wiley, 2nd Edn., 2014.

Communicative English

Code: ENGUGHU01
Contracts: 3L
Credits: 3
Objectives of the Course: To impart basic Communication skills to the first year UG students in the English language through rigorous practice and use of various categories of common words and their application in sentences; to enable them to achieve effective language proficiency for their social, professional &inter personal communication both in speaking & writing.

Couse Outcomes:

CO 1: Understand the fundamentals of communication, including its types, processes, and barriers, and apply them in various professional and personal contexts.
CO 2: Develop effective listening and speaking skills, including strategies for presentations, pronunciation, and articulation.
CO 3: Enhance reading and writing skills, including critical reading, technical report writing, and the proper use of language for clear and effective communication.
CO 4: Apply business communication principles to write various business documents such as letters, reports, proposals, and job applications.

CO – PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12
CO1	3	2	1	2	2	1	2	2	2	2	1	1
CO2	2	3	2	2	1		2	2	2	2		
CO3	2	2	3	2	2		2	3	2	2		2
CO4	2	2	2	3	3	2	3	2	3	3	2	

Module no	Content of the module	Allotted hour
1	**Fundamentals of Communication:** Communication: Meaning, Nature, Process, Importance and Function of Communication; Levels of Communication: Intra-personal, Interpersonal, Organizational, Mass Communications; The Flow of Communication: Downward, Upward, Lateral or Horizontal, Diagonal, Grapevine Communication; Network in an Organization; Principles for Effective Communication; Verbal and Non-Verbal Communication; Barriers to Communication, Gateways to Communication.	
2	**Listening and Speaking Skills** The Process of Listening; Barriers to Listening; Types of Listening: Active and Passive Listening; Methods for improving listening skills, Benefits of Effective Listening. Presentation Strategies: Defining Purpose; Organizing Contents; Preparing Outline; Audio-visual Aids; Nuances of Delivery; Body Language; Dimensions of Speech – Accent, Pitch, Rhythm, Intonation, Strong and Weak Forms, Connected Speech- Assimilation and Elision, Paralinguistic Features of Voice; Articulation of Speech Sounds- Vowels and Consonants; Spelling and Pronunciation; Problems of Indian speakers of English and their remedial measures.	
3	**Reading and Writing Skills** **Reading Skills:** Purpose, Process, Methodologies, and Strategies; Special Reading Situations – Skimming and Scanning, Intensive and Extensive Reading, Critical Reading, Drawing Inferences, Reading Technical Reports, etc. **Writing Skills:** Words and Phrases: Word Formation, Synonyms and Antonyms, Homophones, One Word Substitutes, Words Often Confused, Word Choice - Right Words, Appropriate Words, Idioms and Phrases; Correct Usage: Parts of Speech, Modals, Concord,	

	Articles, Infinitives, Requisites of Sentence Construction. Elements of Effective Writing, Main Forms of Written Communication: Paragraph - Techniques and Methods (Inductive, Deductive, Linear, Spatial, Chronological etc.), The Art of Condensation- various types (Précis, Summary and Abstract, etc.), Description, Agenda, Minutes, Notices, Circulars, Memo, Advertisements, Drafting an E-mail, Press Release.	
4	**Business Communication** Business Letters: Principles; Sales & Credit letters; Claim and Adjustment Letters; Job application and Résumés. Reports: Types; Significance; Structure, Style & Writing of Reports. Technical Proposal; Parts; Types; Writing of Proposal. Negotiation & Business Presentation skills.	

Suggested Books:

1. Sethi, J &et al.:"A Practice Course in English Pronunciation", Prentice Hall of India, New Delhi.
2. Berry Cicely: "Your Voice and How to Use it Successfully", George Harp & Co. Ltd, London
3. Bansal, R.K. and J.B. Harrison:"Spoken English", Orient Longman.
4. Hornby's, A.S.:"Oxford Advanced Learners Dictionary of Current English", 7th Edition, Oxford University Press.
5. Pillai, Sabina &Agna Fernandez: "Soft Skills & Employability Skills",Cambridge Univ. Press.
6. Sudharshana, N.P. & C. Savitha: "English for Technical Communication", Cambridge Univ. Press.
7. Raman, Meenakshi& Sangeeta Sharma: "Technical Communication: Principles and Practice",Oxford Univ. Press.
8. Prasad, P.:"The Functional Aspects of Communication Skills", Delhi.
9. McCarthy, Michael:"English Vocabulary in Use", Cambridge University Press, Cambridge.
10. Leech, G &Svartvik, J. A: "Communicative Grammar of English", Pearson Education. New Delhi.
11. NarayanaswamyV.R.:"Strengthen your Writing", Orient Longman, London.
12. Dean, Michael:"Write it", Cambridge University Press, Cambridge.
13. Sen, Leena:"Communication Skills", Prentice Hall of India, New Delhi.
14. Bown, G.:"Listening and Spoken English", Longman, London

Programming for Problem Solving Lab

Code: CSEUGES02
Contracts: 4P
Credits: 2

Course Outcomes:

CO 1: Demonstrate proficiency in using the Linux environment and basic commands for programming tasks.

CO 2: Design flowcharts and algorithms to solve computational problems using the Raptor tool.

CO 3: Implement C programs using operators, control statements, and conditional logic for problem-solving.
CO 4: Apply functions and recursion techniques to develop modular programs.
CO 5: Utilize arrays and strings for data processing and demonstrate proficiency in manipulating them in C.
CO 6: Apply knowledge of structures, unions, and enums to create organized data structures.
CO 7: Implement dynamic memory management using pointers and pointer arithmetic.
CO 8: Develop programs using data structures like stacks, queues, linked lists, and file handling for efficient data management.

CO – PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**3**	**2**			**2**							**2**
CO2	**3**	**3**			**2**					**2**		**2**
CO3	**3**	**3**	**3**		**3**							
CO4	**3**	**3**	**3**		**3**				**2**	**2**		**2**
CO5	**3**	**3**	**2**		**3**							
CO6	**3**	**2**	**2**		**2**	**3**		**2**				
CO7	**3**	**2**	**2**		**3**	**3**	**2**					**2**
CO8	**3**	**2**	**3**	**3**	**3**	**2**				**2**	**3**	**2**

Week 1 Ubuntu and Linux Commands.
Week 2 Designing of flowcharts and algorithms using raptor tool 1.Areas of Polygons. 2. Calculation of Simple and Compound Interest. 3. Swapping of Two numbers with and without temporary variable. 4. Checking whether a number is even or odd. 5. Sum of first 'n' natural numbers. 6. Checking a number whether it is divisible by any given number. 7. Evaluation of mathematical expressions. 8. Programs using scanf( ) and printf( ) statements.
Week 3,4 Programs on operators. (Minimum 4 Programs) Programs on Conditional Statements. (Minimum 4 Programs) Programs on Control Statements. (Minimum 4 Programs)
Week 5 Programs on Functions. (Minimum 6 Programs)
Week 6 Programs on One Dimensional and Two Dimensional Arrays. (Minimum 2 Programs)
Week 7 Programs on Strings with and without string built-in Functions. (Minimum 4 Programs)
Programs on Accessing Structures and Nested Structures. (Minimum 2 Programs)
Week 8 Programs on Array of Structures, Structures and Functions. (Minimum 4 Programs) Programs on Unions, typedef and enum. (Minimum 2 Programs)
Week 9 Programs on Pointers, pointer arithmetic, pointer expression, One Dimensional and Two dimensional arrays. (Minimum 4 Programs)
Week 10 Programs on Pointer to structure, Call by Reference, Pointer to Pointer. (Minimum 3 Programs) Programs on Dynamic Memory Allocation Functions. (Minimum 3 Programs)
Week 11 Programs on Stacks and Queues using Arrays.
Week 12 & 13 Programs on Single Linked List.
Week 14 & 15 Programs on File Operations. (Minimum 6 Programs)
Week 16 Review

Suggested Books:

1. B.S. Gottfried: "Programming in C", TMH.

2. B.W. Kernighan and D.M. Ritchie: "The C Programming Language", PHI.
3. H. Schildt: "C++: The Complete Reference", TMH, 4e.
4. B. Stroustrup: "The C++ Programming Language", Addison-Wesley.
5. E. Balagurusamy: "Programming in ANSI C", TMH.
6. YashwantKanetkar: "Let Us C", BPB Publications.
7. K. N. King: "C Programming: A Modern Approach", W. W. Norton and Company.
8. PradipDey and Manas Ghosh: "Programming in C", Oxford University Press.

Basic Electrical Engineering Lab

Code: EENUGES02
Contracts: 3P
Credits: 1.5

Couse Outcomes:

CO 1: Apply theorems like Thevenin's, Norton's, and Superposition in practical electrical circuits.
CO 2: Perform measurements and testing on electrical equipment like transformers, motors, and lamps.
CO 3: Analyze the characteristics of various electrical components, such as lamps, motors, and R-L-C circuits.
CO 4: Calibrate electrical instruments and perform continuity tests to ensure proper functioning of electrical systems.

CO – PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12
CO1	3	3			2							
CO2	2	3	2	2								
CO3	2	2	3	3	2	2		2				
CO4	3	2	3	2		2		2				

List of experiments:

1. Verification of Thevenin's Theorem
2. Verification of Norton's Theorem
3. Verification of Superposition Theorem
4. Verification of Maximum Power Transfer theorem
5. Power Measurement of Fluorescent Lamp
6. V-I characteristics of Incandescent Lamp
7. Speed Control of DC motor Using Field and Armature Control Method
8. Starting and reversing of DC motor
9. Open circuit and Short circuit test of Single Phase Transformer
10. Calibration of Voltmeter and Ammeter
11. Characteristics of Series R-L-C Circuit

12. Characteristics of Parallel R-L-C Circuit
13. Resistance measurement and continuity test of DC motor using Megger.

Suggested Books:

1. 1. Hazra Choudhury&Hazra Choudhury:"Elements of Workshop Technology, Vol. I & II", Media Promoters and Publishers Pvt. Ltd.
2. Rajender Singh:"Introduction to Basic Manufacturing Process and Workshop Technology", New Age International.

Workshop Practice

Code: MENUGES02
Contracts: 1T+2P
Credits: 2

Couse Outcomes:

CO 5: Understand the usage of various hand tools, basic instruments, and their applications in workshop practice.
CO 6: Gain proficiency in operating basic workshop machines such as Lathe, Milling, Drilling, and Grinding.
CO 7: Develop skills in practical exercises, including measuring, marking, sawing, chipping, filing, and machining processes like turning and drilling.
CO 8: Apply knowledge of machine safety and proper maintenance in a workshop environment

CO – PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12
CO1	2	2		3	2	1	2		2	3		2
CO2	3	3		3	2	2	2	2		2		1
CO3	2	3	3	3	2	2	3	3	2	3		
CO4	1	2		2	2	3	2	2	2	2	3	2

Introduction to various hand tools e.g.allen keys, spanners, punch, files, hacksaw, hammers, chisels, vices, marking block, angle plates, etc.
Introduction to basic instruments: Vernier Caliper, Micrometer, Tri-square, Surface Plate, Height Gauge, Vernier Bevel Protractor, Screw Pitch Gauge, Radius Gauge, etc.
Demonstration on different machines and Equipments: Lathe, Milling, Drilling, Shaping, Radial Drilling, Grinding, Welding, Power Saw, Power Press, Planer Machine, Microscope, Profile Projector, etc.
Practical Exercises: Exercises involving the following operations: measuring and marking, sawing, chipping, filing, maintaining of perpendicularity of all surfaces by filing, making of taper surface by filing, making of curved surface by filing, plain turning, step turning and drilling.

Suggested Books:

1. 1. HazraChoudhury&HazraChoudhury:"Elements of Workshop Technology, Vol. I & II", Media Promoters and Publishers Pvt. Ltd.
2. RajenderSingh:"Introduction to Basic Manufacturing Process and Workshop Technology", New Age International.

Engineering Chemistry Lab

Code: CHMUGBS02
Contracts: 3P
Credits: 1.5

Couse Outcomes:

CO 1: Perform quantitative chemical analysis techniques such as acidimetric, complexometric, and permanganometric titrations.
CO 2: Analyze the total hardness of water using complexometric methods and apply theoretical knowledge to practical applications.
CO 3: Conduct qualitative analysis of organic compounds, identifying functional groups and other chemical properties.
CO 4: Develop skills in laboratory techniques, including titration methods and qualitative analysis procedures.

CO – PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12
CO1	3	3	2	3	2				2			
CO2	3	3	2	2	1	2			2			
CO3	2	3	2	3	2				2		2	
CO4	3	3	3	3	2	2			3	2		

List of experiments:

1. Acidimetric estimation of Sodium Carbonate and Sodium bi-Carbonate in their mixture.
2. Estimation of Total Hardness of water by Complexometric method
3. Estimation of Fe^{II} in Mohr's Salt by Permanganometric Titration.
4. Qualitative analysis of single solid organic compounds.

Suggested Books:

1. **"Chemistry for Engineers"** by **J. D. Lee**
2. **"Physical Chemistry for Engineers"** by **K. J. Laidler**
3. **"A Textbook of Engineering Chemistry"** by **S.S. Dara and S. Umare**

Language Lab

Code: ENGUGHU02
Contracts: 2P
Credits: 1

Objectives of the Course: To impart basic Communication skills to the first year UG students in the English language through rigorous practice and use of various categories of common words and their application in sentences; to enable them to achieve effective language proficiency for their social, professional & inter personal communication both in speaking & writing; to improve their English pronunciation.

Course Outcomes:

CO 1: Develop effective grammatical communication skills through practical sessions.
CO 2: Enhance conversational skills and interpersonal communication for professional settings.
CO 3: Build presentation skills and comprehension abilities for academic and professional communication.
CO 4: Strengthen listening and speaking proficiency, including pronunciation, stress, and intonation mechanics.

CO – PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12
CO1	3	2		2			2					
CO2	3	2	2	3		2	2					
CO3	2	3	3	2		2	3	3				
CO4	2	3	3	2	2		3	2				2

Laboratory Practical:

1. Group Discussion: Practical based on Accurate and Correct Grammatical Patterns.
2. Conversational Skills under suitable Professional Communication Lab conditions with emphasis on Kinesics: Interview, Greeting and Introducing, Leave taking, Asking Questions and Giving Replies, Inviting Friends and Colleagues, Negotiating, Persuading, Taking Initiatives, Praising and Complementing People, Expressing Sympathy, Seeking and Giving Permission, Complaining and Apologizing, Official/Public Speaking, Telephoning etc.
3. Communication Skills for Seminars/Conferences/Workshops with emphasis on Paralinguistic/ Kinesics.
4. Presentation Skills for Technical Paper/Research Paper/Project Reports/ Professional Reports based on proper Stress and Intonation Mechanics.
5. Extempore, Argumentative Skills, Role Play Presentation with Stress and Intonation.
6. Comprehension Skills based on Reading and Listening Practical on a model Audio-Visual Usage.

Suggested Books:

1. Bansal R.K. & Harrison: “Phonetics in English”, Orient Longman, New Delhi.

2. Sethi&Dhamija: “A Course in Phonetics and Spoken English”, Prentice Hall, New Delhi.
3. Pandey, L.U.B. &R.P.Singh: “A Manual of Practical Communication”, A.I.T.B.S. Pub. India Ltd. Krishan Nagar, Delhi.
4. Joans, Daniel:“Cambridge English Pronouncing Dictionary”, Cambridge Univ. Press.
5. Sudharshana, N.P. & C. Savitha: “English for Technical Communication”, Cambridge Univ. Press.

Semester III:

Data Structures & Algorithms

Code: CSEUGPC01
Contracts: 3L+1T
Credits: 4

Course Outcomes:

CO 1: Understand basic concepts of Data Structure and data types.
CO 2: Analyze the time and space complexities of Algorithms.
CO 3: Design a solution to a given problem using arrays and using pointers, functions.
CO 4: Develop applications using stacks, queues and linked lists
CO 5: Choose the appropriate nonlinear data structure and perform operations on them.
CO 6: Choose suitable sorting techniques to maximize the performance.
CO 7: Illustrate operations on Efficient Binary Search Trees and Multiway Search Trees. Select the hashing techniques to perform dictionary operations.

CO – PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12
CO1	3	2										
CO2	3	3	3		2							
CO3	3	3	3		2							
CO4		3	2		2							2
CO5		3	3	2	3							2
CO6			3	2	2							
CO7	3	3			2							

Module - 1 [12 Hrs]
Introduction: Data and Information, Program Structures, Abstract Data Type, Data Structure - Static and Dynamic Data Structures.
[2L]
Array as a Data Structure: Representation of Polynomials and Sparse Matrix, Linear List, Implementation using array, Review of Pointers and Functions.
[4L]
Linked List representations: Single Linked Lists, Doubly Linked Lists, Circularly Linked Lists, Linked List Representation of Polynomial And Applications.
[6L]
Module - 2 [12 Hrs]
Concepts of Algorithm Design Techniques: Divide and Conquer, Greedy, Dynamic Programming, Backtracking, Branch and Bound.
[3L]
Concepts of Algorithm Analysis: Performance Measurement and Analysis, Time Complexity and Space Complexity, Introduction to Order functions, Examples of Analysis.
[3L]

Sorting and searching algorithms: Bubble sort, Insertion sort, Selection sort, Merge, Quick, Heap, Radix, Bucket sort, Linear and Binary Search. [6L]

Module - 3 [12 Hrs]

Stack and Queue: Implementations using Arrays and Linked List, Applications, Expression Evaluation and Conversions.
[4L]

Trees: Binary Trees, Binary Search Trees, Height-Balanced And Weight-Balanced Trees, 2-3 Tree, B-Trees, B+ -Trees. Applications of Trees. [8L]

Module - 4 [12 Hrs]

Recursion: Basic concept, Design of recursive algorithms, Tail recursion. [2L]

Graphs: Adjacency Matrix and List, Graph Search Algorithms, Spanning Tree Algorithms, Shortest Path Algorithms.
[6L]

Hashing: Terminologies, Hashing Functions, Collision Resolution Techniques, Types of Hashing.

[4L]

Suggested Books:

1. E. Horowitz, S. Sahni and S. Anderson-Freed:"Fundamentals of Data Structures in C", Second Edition, Universal Press. 2007.
2. M. A. Weiss:"Data Structures and Algorithm Analysis in C", Second Edition, Pearson Education, 2002.
3. A. V. Aho, J. E. Hopcroft and J. D. Ullman:"Data Structures and Algorithms", First Edition, Pearson Education, 2002.
4. R. K. Kruse, Bruce P. Leung:"Data Structures and Program Design", Prentice Hall, 2006.
5. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein:"Introduction to Algorithms", Third Edition, PHI Learning Pvt. Ltd, 2010.
6. Y. Langsam, J. M. Augenstein, M. A. Tenenbaum:"Data Structures using C and C++", Second Edition, Pearson Education. 2015.

Digital Logic

Code: CSEUGPC02
Contacts: 3L
Credits: 3

Course outcomes:

CO 1: Understand the principles and methodology of digital logic design.
CO 2: Understand the different number systems, binary addition and subtraction, 2's complement representation and operations with this representation.

CO 3: Understand Boolean algebra and basic properties of Boolean algebra, able to simplify simple Boolean functions by using the basic Boolean properties.

CO 4: Analyse and synthesize the functionality of basic combinational logic circuits such as Adder, subtractor, encoder, decoder, comparator etc.

CO 5: Analyse and synthesize the functionality of basic sequential logic components such as flip-flops, registers and counters.

CO 6: Understands and implements the Diodes, transistors, MOS, CMOS etc.

CO – PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12
CO1	2	1	1									
CO2	2		2									
CO3	2	1		1	1			1				
CO4	2	3	2	2								
CO5	2	3	2	2								
CO6	2	1	3	2	2			1			2	

Module-1: [12 Hrs]

Number Systems, Boolean Algebra & Logic Gates: Binary numbers & Boolean algebra, Venn diagram, Logic gates, Truth Tables and function minimization using algebraic method, Karnaugh map, Quine- Mcclusky method; BCD, ASCII, EBDIC, Gray codes and their conversions, Signed binary number representation with 1's and 2's complement methods, Maxterm, Minterm, Representation in SOPand POS forms ;Realization of Boolean functions using NAND/NOR gates, two-level and multilevel logic circuit synthesis.

Module-2: [12 Hrs]

Combinational circuits: Adder and Subtractor circuits (half & full adder &subtractor); Encoder, Decoder, Comparator, Multiplexer, De-Multiplexer and Parity Generator and checker; ROM, PLA .

Sequential Circuits: Latch, Flip-flop. Design of Flip-flops with logic gates, counters, registers. Design and analysis of sequential circuits -Moore and Mealy model description, state diagram and state table – Minimization methods.Memoryunit.Racing and Logic hazards.Implementation of hazard free logic circuit,asynchronous sequential circuit synthesis.

Module-3: [12 Hrs]

Digital Integrated Circuits: Diode as switch. Use of diodes in AND, OR Circuits.Transistor as a switch. RTL, DTL, TTL logic gate circuits. MOS as a switch.Basic MOS inverter.MOS and CMOS logic gates. Fan -in and Fan-out of logic gates, propagation delay, Tristate logic.

Suggested Books:

1. Floyed and Jain: "Digital Fundamentals", Pearson Education.
2. Morries Mano: "Digital Logic Design", PHI.
3. Leach &Malvino: "Digital Principles & Application, 5/e", Tata McGraw Hill.
4. Kharate: "Digital Electronics", Oxford.

5. BigmellandR.Donovan: “Digital Electronics - Logic & Systems”, Cambridge Learning.
6. D.J.Comer: “Digital Logic and State Machine Design, 3/e”, OUP.
7. P.Raja: “Digital Electronics”,Scitech Publications.
8. R.P.Jain: “Modern Digital Electronics, 2/e”,Tata McGraw Hill.
9. H.Taub and D.Shilling: “Digital Integrated Electronics”,Tata McGraw Hill.
10. D.RayChaudhuri: “Digital Circuits, vol I & II, 2/e”, Platinum Publishers.
11. Tocci and Widmer: “Moss-Digital Systems, 9/e”, Pearson Education.
12. J. BignellandR.Donovan: “Digital Electronics, 5/e”, Cenage Learning.

Discrete Mathematics

Code: MATUGBS04
Contacts: 4L
Credits: 4

Course Outcomes:

CO 1: Understand and apply fundamental concepts of sets, relations, functions, and logical reasoning to solve mathematical problems.
CO 2: Use combinatorial methods for counting, permutations, and combinations, including constrained repetitions.
CO 3: Analyze and solve recurrence relations using generating functions and other techniques.
CO 4: Model and work with binary relations, equivalence relations, and digraphs to represent relationships between objects.
CO 5: Understand basic graph theory concepts like trees, spanning trees, Euler circuits, Hamilton paths, and apply them to solve real-world problems.
CO 6: Apply graph coloring techniques and chromatic polynomials to solve problems in scheduling, network design, and optimization.

CO – PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12
CO1	3	2	2	1	-	-	-	-	-	-	-	1
CO2	3	2	1	-	-	-	-	-	-	-	-	1
CO3	3	3	2	1	1	-	-	-	-	-	-	1
CO4	3	2	2	2	1	-	-	-	-	-	-	1
CO5	3	3	2	-	1	2	1	-	-	1	-	-
CO6	3	2	1	-	1	2	1	-	-	-	-	-

UNIT-I: [10 Hrs]
Fundamentals:
Definition of Sets, Venn Diagrams, complements, Cartesian products, power sets, counting principle, cardinality and countability (Countable and Uncountable sets), proofs of some general identitites on sets, pigeonhole principle. Relation: Definition, types of relation, composition of relations, domain and range of a relation, pictorial representation of relation,

properties of relation, partial ordering relation. Function: Definition and types of function, composition of functions, recursively defined functions.

UNIT-II: [8 Hrs]
Propositional logic: Proposition logic, basic logic, logical connectives, truth tables, tautologies, contradiction, normal forms(conjunctive and disjunctive), modus ponens and modus tollens, validity, predicate logic, universal and existential quantification.

UNIT-III: [8 Hrs]
Combinatories: Mathematical induction, recursive mathematical definitions, basics of counting, permutations, combinations, inclusion-exclusion, recurrence relations, generating function

UNIT-IV: [8 Hrs]
Relations and digraphs:
Relations and digraphs, binary relations, equivalence relations, ordering relations, lattices, paths and closures, directed graphs, adjacency matrices.

UNIT-V: [8 Hrs]
Graphs:
Graphs, Isomorphism, Trees, Spanning trees, Binary trees, Walk, Trail, Path, Cycle, Euler Trails and Circuits, Planar Graphs, Hamilton Paths and Cycles, Vertex coloring, Edge coloring, Chromatic Polynomials.

Suggested Books:

1. Kenneth H. Rosen: "Discrete Mathematics and its Applications", McGraw Hill, 2002.
2. J.P.Tremblay& R. Manohar: "Discrete Mathematical Structure with Applications to Computer Science",Mc.Graw Hill, 1975.
3. V. Krishnamurthy: "Combinatories:Theory and Applications", East-West Press.
4. Seymour Lipschutz, M.LiPOn: "Discrete Mathemataics", Tata McGraw Hill, 2005.
5. Kolman, Busby Ross: "Discrete Matheamatical Structures", Prentice Hall International.
6. N Deo: "Graph Theory with Applications to Engineering and Computer Science", Prentice Hall.

Indian Constitution

Code: UCCUGMC03
Contacts: 2L
Credits: 0

Course Outcomes:

CO 1: Understand the historical evolution and the foundational concepts of the Indian Constitution, including constitutional law and constitutionalism.

CO 2: Analyze the structure, salient features, and characteristics of the Constitution, focusing on its federal setup, division of powers, and parliamentary form of government.

CO 3: Examine the scheme of Fundamental Rights, Duties, and the Directive Principles of State Policy, and their significance in ensuring social justice and equality.

CO 4: Evaluate the procedures related to constitutional amendments, emergency provisions, and the role of local self-governance as enshrined in the Constitution.

CO 5: Interpret the scope of fundamental freedoms, the Right to Equality (Article 14), and the Right to Life and Personal Liberty (Article 21), and their implications on citizens' rights.

CO – PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12
CO1	3	2										
CO2	2	3	1									
CO3	2	3	2				2					
CO4	2	3	1			2						
CO5	3	3	2					2				

Module No.	Content	Lecture
1	Meaning of the constitution law and constitutionalism	
2	Historical perspective of the Constitution of India	
3	Salient features and characteristics of the Constitution of India	
4	Scheme of the fundamental rights	
5	The scheme of the Fundamental Duties and its legal status	
6	The Directive Principles of State Policy – Its importance and implementation	
7	Federal structure and distribution of legislative and financial powers between the Union and the States	
8	Parliamentary Form of Government in India – The constitution powers and status of the President of India	
9	Amendment of the Constitutional Powers and Procedure	
10	The historical perspectives of the constitutional amendments in India	
11	Emergency Provisions : National Emergency, President Rule, Financial Emergency	
12	Local Self Government – Constitutional Scheme in India	
13	Scheme of the Fundamental Right to Equality	
14	. Scheme of the Fundamental Right to certain Freedom under Article 19	
15	Scope of the Right to Life and Personal Liberty under Article 21	

Suggested Books:

1. Durga Das Basu, “Introduction to the Constitution of India “, Prentice Hall of India, NewDelhi.
2. R.C.Agarwal, (1997) “Indian Political System”, S.Chand and Company, New Delhi

Data Structures Lab

Code: CSEUGPC03
Contacts: 3P
Credits: 1.5

Course Outcomes:

CO 1: Implement insert, delete, search, sort and traverse operations using arrays and linked lists.
CO 2: Develop applications on stacks and queues.
CO 3: Understand nonlinear data structures to solve computing problems.
CO 4: Implement optimized sorting techniques for a given data set.
CO 5: Implement hashing techniques to perform dictionary operations and binary search trees.
CO 6: Develop applications on linked lists.

CO – PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12
CO1	3	3	3		2							
CO2		3	3		2							
CO3		3	3		2						2	
CO4		3	3	3	2							
CO5				3	3						2	
CO6			3		3						2	

Experiments should include but not limited to:

1. Implementation of various sorting algorithms such as Bubble sort, Insertion sort, Selection sort, Merge sort, Quick sort, Shell sort, Heap sort, Radix sort, Bucket sorting.
2. Implementation of Linear and Binary Search.
3. Implementation of stacks and queues using arrays.
4. Implementation of stacks and queues using linked lists.
5. Applications of linked lists: polynomial arithmetic, set operations, etc.
6. Sparse Matrices: Multiplication, addition.
7. Implementation of Binary Trees, Binary Search Trees, B-Trees, B+-Trees.
8. Implementation of Hash tables.

Reference Books:

1. E. Horowitz, S. Sahni and S. Anderson-Freed:“Fundamentals of Data Structures in C”, Second Edition, Universal Press. 2007.
2. M. A. Weiss:“Data Structures and Algorithm Analysis in C”, Second Edition, Pearson Education, 2002.
3. A. V. Aho, J. E. Hopcroft and J. D. Ullman:“Data Structures and Algorithms”, First Edition, Pearson Education, 2002.

4. R. K. Kruse, Bruce P. Leung:"Data Structures and Program Design", Prentice Hall, 2006.
5. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein:"Introduction to Algorithms", Third Edition, PHI Learning Pvt. Ltd, 2010.
6. Y. Langsam, J. M. Augenstein, M. A. Tenenbaum:"Data Structures using C and C++", Second Edition, Pearson Education. 2015.

Digital Logic Lab

Code: CSEUGPC04
Contacts: 3P
Credits: 1.5

Course outcomes:

CO 1: Implementation of the basic logic gates using diodes.
CO 2: Realize the characteristics of logic family.
CO 3: Design the combinational circuits.
CO 4: Implement the various Boolean functions.
CO 5: Design the basic sequential circuits.

CO – PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12
CO1	2	3	3		2							
CO2	2	2	1									
CO3	2	3	3		3							
CO4	1	2	3		1							
CO5	2	3	3		3							

1. **Logic family:** Implementation of OR and AND gates using diodes, Study on characteristics of DTL and TTL inverters using discrete components, Study on characteristics of TTL and CMOS gates.

2. **Combinational logic circuits:** Design and implementation of combinational circuits such as, Adders, comparators, parity generator and checker. Implementation of Boolean functions using multiplexer and decoder/de-multiplexer.

3. **Sequential circuits:** Study of latch and flip-flop, design of counters.

Suggested Books:

1. Floyed and Jain: Digital Fundamentals, Pearson Education.
2. Morries Mano: Digital Logic Design, PHI.
3. Leach &Malvino: Digital Principles & Application, 5/e, Tata McGraw Hill.
4. Kharate: Digital Electronics, Oxford.
5. Bigmell and R.Donovan: Digital Electronics - Logic & Systems; Cambridge Learning.
6. D.J.Comer: Digital Logic and State Machine Design, 3/e. OUP.
7. P.Raja: Digital Electronics, Scitech Publications.

8. R.P.Jain: Modern Digital Electronics, 2/e, Tata McGraw Hill.
9. H.Taub and D.Shilling: Digital Integrated Electronics, Tata McGraw Hill.
10. D.Ray Chaudhuri: Digital Circuits, vol I & II, 2/e, Platinum Publishers.

Semester IV:

Object Oriented Programming Systems

Code: CSEUGPC05
Contacts: 3L
Credits: 3

Course Outcomes:

CO 1: Demonstrate an understanding of the need for the Object-Oriented Programming (OOP) paradigm and its core principles, including the benefits and applications of OOP.

CO 2: Explain the fundamental concepts of Java programming, including its history, key features (Java Buzzwords), and foundational elements such as data types, variables, operators, and control structures. Develop and execute simple Java programs.

CO 3: Develop Java programs using classes and objects, employing constructors, method overloading, and various forms of parameter passing. Understand and apply concepts like this keyword, garbage collection, recursion, nested/inner classes, and string manipulation.

CO 4: Apply the concept of inheritance in Java, including understanding base and subclass relationships, member access rules, and method overriding. Utilize keywords like super, static, and final, and implement polymorphism through method overriding and abstract classes.

CO 5: Design and use packages and interfaces in Java, manage access control, and differentiate between classes and interfaces. Implement interfaces and understand the use of CLASSPATH.

CO 6: Implement and manage exception handling in Java, understanding the exception hierarchy and applying constructs such as try, catch, throw, throws, and finally. Create custom exception classes for specific scenarios.

CO – PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12
CO1	3	2	1	-	-	-	-	-	-		-	2
CO2	3	3	2	-	2	-	-	-	-	1	-	2
CO3	3	3	3	2	3	-	-	-	2	2	-	2
CO4	3	3	2	-	2	-	-	-	1	1	-	2
CO5	3	2	2	-	2	-	-	-	2	1	-	2
CO6	3	3	3	2	2	-	-	-	1	1	-	2

UNIT I: Object Oriented Thinking [3 Hrs]
Need for OOP Paradigm, Principles of Object Oriented Languages, Benefits of OOP, Applications of OOP.

UNIT II: Java Basics [6 Hrs]
History of Java, Java Buzzwords, Java Virtual Machine, Platform Independence, Data Types, Variables, Scope and Life time of variables, Operators, Expressions, Control Statements, Type Conversion and Casting, Simple Java Program.

UNIT III: Classes and Objects [5 Hrs]
Concepts of Classes, Objects, methods,constructors, this keyword, garbage collection, Compile time polymorphism: overloading methods and constructors, parameter passing, command line arguments,Recursion, nested and inner classes, Exploring String, StringBuffer classes, Arrays.

UNIT III: Inheritance [4 Hrs]
Hierarchical abstractions, Base class object, subclass, subtype, forms of inheritance, benefits of inheritance, Member access rules, Usage of super, staticand final with inheritance, Run time polymorphism: method overriding, abstract classes, the Object class.

UNIT IV: Packages and Interfaces [3 Hrs]
Defining, Creating and Accessing a Package, Understanding CLASSPATH, access control, differences between classes and interfaces, defining an interface, implementing interface, variables in interface and extending interfaces.

UNIT V: Exception Handling [5 Hrs]
Concepts of exception handling, benefits of exception handling, exception hierarchy, usage of try, catch, throw, throws and finally, built in exceptions, creating own exception classes: throw and throws.

UNIT VI: Multithreading [6 Hrs]
Differences between multi-threading and multitasking, thread life cycle, creating threads, thread priorities, synchronizing threads, inter thread communication, thread groups, daemon threads.

UNIT VII: Applet Programming [4 Hrs]

Applet & Application, Applet Architecture, Parameters to Applet, Embedding Applets in Web page, Applet Security Policies

Suggested Books:

1. E Balagurusamy: “Programming with Java”, McGraw Hill Education
2. Herbert Schildt:“Java: The Complete Reference”,McGraw Hill Education
3. Sachin Malhotra and Saurabh Choudhary:“Programming in Java”, Oxford University Press
4. Y. Daniel Liang:“Introduction to Java Programming, Brief Version”, Pearson Education
5. Y. Daniel Liang:“Introduction to Java Programming, Comprehensive Version”, Pearson Education

6. Cay S. Horstmann: "Core Java - Vol. I, Vol. II and Vol. II", Pearson Education
7. E. Balagurusamy: "Object-Oriented Programming with C++", McGraw Hill Education
8. Bjarne Stroustrup: "The C++ Programming Language", Pearson Education
9. R. Lafore: "Object Oriented Programming in C++", Pearson Education
10. Debasish Jana: "C++ and Object-Oriented Programming Paradigm", PHI Learning

Computer Organization& Architecture

Code: CSEUGPC06
Contacts: 3L+1T
Credits: 4

Course Outcomes:

CO 1: Analyze how the Computer Systems work &how whole and fraction numbers stored in it.
CO 2: CO2: Apply stored program concepts and different arithmetic and control unit operation to design complex system.
CO 3: Design memory hierarchy and mapping techniques.
CO 4: Analyze the data transfer mechanism and working mechanism of I/O devices.
CO 5: Apply pipelining concepts with a prior knowledge of stored program methods.

CO – PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12
CO1		3	1									
CO2	3											
CO3			3									
CO4		3										
CO5	3											

UNIT I
Introduction: [2 Hrs]
History of computing, von Neumann machine, Instruction and data, fixed-point and floating point numbers, errors, IEEE standards

UNIT II
Processor design: [7 Hrs]
Instruction Set Architecture-Instruction format, opcode optimization; operand addressing; Instruction implementation-data movement, branch control, logical, Input/output and debugging instructions; arithmetic instruction implementation–addition and subtraction, multiplication-division, 2's complement multiplication; Booth's algorithm–theory and examples; bit-pair algorithm; high performance arithmetic

UNIT III
Control unit design: [8 Hrs]
Hardwired control, micro-programmed control design – micro-instruction formats, control optimization;

UNIT IV
Memory subsystem: [9 Hrs]
Memory technology, memory interfacing, Memory hierarchy–introduction to virtual memory system; Cache memory – performance, address mapping, content addressable memory (CAM), FloppyDisks.

UNIT V
Peripherals: [7 Hrs]
Basic properties, bus architectures, interfacing of I/O devices, data transfer schemes – programmed I/O, DMA, mass storage, RAID

UNIT VI
Pipelining: [3 Hrs]
Pipelining datapath and instructions, speed up, CPI, latency; linear / non-linear pipeline– reservation table, MAL; super-pipelined and super-scalar processors.

Suggested Books:

1. Mano, M.M., "Computer System Architecture", PHI.
2. BehroozParhami: "Computer Architecture", Oxford University Press
3. Hayes J. P.: "Computer Architecture & Organisation", McGraw Hill,
4. Hamacher: "Computer Organisation", McGraw Hill,
5. N. senthil Kumar, M. Saravanan, S. Jeevananthan: "Microprocessors and Microcontrollers" OUP.
6. Chaudhuri P. Pal: "Computer Organisation & Design", PHI.
7. P N Basu: "Computer Organization & Architecture", Vikas Publishing.
8. J. L. Hennessy and D. A. Patterson:"Computer Architecture: A Quantitative Approach", 3rd & 4th ed, Elsevier.
9. Kai Hwang:"Advanced Computer Architecture: Parallelism, Scalability, Programmability", TMH.

Probability & Statistics

Code: MATUGBS05
Contacts: 3L
Credits: 3

Course Outcomes:

CO 1: Understand the fundamental concepts of probability, including sample spaces, events, and probability functions.
CO 2: Analyze random variables and probability distributions (discrete and continuous) and compute mathematical expectations, moments, and moment-generating functions.
CO 3: Apply concepts of joint probability distributions, correlation, and regression to analyze relationships between multiple random variables.
CO 4: Interpret sampling distributions, estimate parameters, and compute standard errors for statistical analysis.

CO 5: Perform hypothesis testing using various statistical tests like t-test, Chi-square, and F-distributions to validate assumptions.

CO 6: Understand queuing theory and stochastic processes, including Markov chains, and their applications in modeling real-world systems.

CO – PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12
CO1	3	3										2
CO2	3	3	2									2
CO3	3	3	3							2		2
CO4	3	2	3						2	2	2	2
CO5	3	3	3							2		2
CO6	3	2	3	2	2	3					2	2

UNIT-I: [5 Hrs]

Mathematical Theory of Probability: Basic concepts, Classical and axiomatic approaches, Sample space and events, Properties of probability functions, Conditional probability and independent events.

UNIT-II: [8 Hrs]

Single Random variables & probability distributions: Random variables - Discrete and continuous. Probability distributions, mass function/ density function of probability distribution. Mathematical Expectation, Moment about origin, Central moments Moment generating function of probability distribution.Binomial, Poisson & normal distributions and their properties.Moment generating functions of the above three distributions, and hence finding the mean and variance.

UNIT-III: [7 Hrs]

Multiple Random variables, Correlation & Regression: Joint probability distributions-Joint probability mass/ density function, Marginal probability mass & density functions, Covariance of two random variables, Correlation Coefficient of correlation, Regression Coefficient, Central limit theorem.

UNIT-IV: [7 Hrs]

Sampling Distributions & Parameter estimation: Definitions of population, sampling, statistic, parameter. Types of sampling, Expected values of Sample mean and variance, sampling distribution, Standard error, Sampling distribution of mean and sampling distribution of variance, likelihood estimate, interval estimations.

UNIT-V: [6 Hrs]

Testing of hypothesis: Null hypothesis, Alternate hypothesis, type I, & type II errors - critical region, confidence interval, Level of significance, Once sided test, Two sided test, Student t-distribution, F-distribution, Chi-square test of goodness of fit.

UNIT-VI: [7 Hrs]

Queuing Theory & Stochastic processes: Structure of a queuing system, Operating characteristics of queuing system, Introduction to Stochastic Processes - Classification of Random processes, Methods of description of random processes, Stationary and non-stationary random process, Markov process, Markov chain.

Suggested Books:

1. Seymour Lipschutz and John J. Schiller: "Introduction to Probability and Statistics",
2. S. K. Mapa: "Higher Algebra (Abstract & Linear)",
3. A. Banerjee, S. K. De and S. Sen: "Mathematical Probability",
4. C.W.Helstrom: "Probability and Stochastic Processes for Engineers",
5. K.B.Datta and M.S.Sriniva: "Mathematics for Engineers", Cengage Publications.
6. T.K.V.lyengar&B.Krishna Gandhi Et: "Probability and Statistics",
7. S C Gupta and V.K.Kapoor: "Fundamentals of Mathematical Statistics",
8. Jay I.Devore: "Probability and Statistics for Engineers and Scientists",

Biology for Engineers

Code: BIOUGBS01
Contracts: 2L
Credits: 2

Course Outcomes:

CO 1: Understand the diversity of life, cell structure, and the fundamental principles of evolution.
CO 2: Explain the central dogma of molecular biology, including genetic inheritance and disorders.
CO 3: Analyze the principles of bioenergetics and key metabolic pathways like glycolysis and the Krebs cycle.
CO 4: Describe the structure and function of biomolecules such as proteins, nucleic acids, carbohydrates, and lipids.
CO 5: Understand immunology concepts, including the human immune system, vaccines, and basics of biosafety.

CO –PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12
CO1	3	2				2						2
CO2	3	2										2
CO3	3	2	2									2
CO4	3	3										
CO5	3	2			2	3						2

Module No.	Content of the module	Allotted hour
1	Diversity of Life-prokaryotes and eukaryotes, non chordates and	5

	chordates; Origin of life and Darwinian Evolution, Synthetic theory of evolution	
2	Cell and Cell theory, Cellular structure and function, central dogma of molecular Biology, Concept of Gene and Allele, Genetic disorder, Genetic code, Understanding inheritance patterns through pedigree	5
3	Organismal physiology, Bioenergetics, Exothermic and endothermic vs. Exergonic and endergonic reaction (include Glycolysis, Krebs cycle and photosynthesis)	4
4	Biomolecules, monomers and polymers, Nucleotides and DNA/RNA, Amino acids and proteins, carbohydrates and lipids, hierarchy of protein structure, structure function correlation , enzymes and their mode of action	5
5	Immunology- Self vs. Non Self, pathogens, human immune system , antigen-antibody reactions, Vaccines, Nervous system- impulse transmission	4
6	Biosafety, bioresources, Drug design principle	2
7	Engineering designs inspired by examples in biology (compare eye and camera, bird flight and aircraft	3
8	Engineering aspects of some Nobel Prizes in physiology and Medicine	2

Suggested Books:

1. B.D. Singh: "Textbook of Genetics", Kalyani Publishers.
2. Alberts, B., Johnson, A., Lewis, J., et al.: "Molecular Biology of the Cell", Garland Science.
3. Campbell, N.A., Reece, J.B.: "Biology", Pearson Education.
4. Stryer, L.: "Biochemistry", W.H. Freeman & Co.
5. Karp, G.: "Cell and Molecular Biology: Concepts and Experiments", John Wiley & Sons.

Environmental Science

Code: UCCUGMC02
Contacts: 2L
Credits: 0

Course Outcomes:

CO 1: Understand the fundamental concepts of environment, population growth, and resource management.
CO 2: Analyze the causes and effects of various types of environmental degradation, such as air, water, and land pollution.
CO 3: Explain ecological systems, including the structure of ecosystems, biotic and abiotic components, and ecological balance.
CO 4: Assess the impact of air pollution, greenhouse effects, climate change, and ozone depletion on the environment and human health.
CO 5: Apply sustainable development principles and pollution prevention techniques to minimize environmental impact.

CO –PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12
CO1	**3**	**2**				**2**	**3**					**2**
CO2	**3**	**3**	**2**			**3**	**2**					**2**
CO3	**3**	**2**					**2**					**2**
CO4	**3**	**3**	**2**	**2**	**2**	**3**						**2**
CO5	**2**				**2**	**3**	**3**					**3**

UNIT I [4 Hrs]

Basic ideas of environment, basic concepts related to environmental perspective, man, society and environment, their inter relationship.

Mathematics of population growth and associated problems, definition of resource, types of resource: renewable, non-renewable, potentially renewable, effect of excessive use vis-à-vis population growth, pollutant and contaminant. Environmental impact assessment.

Environmental degradation: Acid rain, toxic element, particulates, noise pollution, air pollution, effect of pollution on man.

Overall methods for pollution prevention, components of environment, environmental problems and sustainable development

UNIT II [3 Hrs]

Elements of Ecology:System, open system, closed system, definition of ecology, species, population, community, Ecosystem, biotic and abiotic components.

Ecological balance and consequence of change:Effect of abiotic factor on population, flow chart of different cycles with only elementary reaction [oxygen,nitrogen, phosphate, sulphur], food chain

UNIT III [10 Hrs]

Overview of Air Pollution and Control

Atmospheric Composition: Troposphere, stratosphere, mesosphere, thermosphere, tropopause, stratopauseandmesopause.

Energy Balance:Conductive and convective heat transfer, radiation heat transfer, simple global temperature model [Earth asa black body, earth albedo]), problems.

Green-house effects, Climate, weather:Difference between climate and weather, Global warming and its consequence, Atmospheric dispersion, Source and effect of pollutants, Primary and secondary pollutants:Emission standard, Depletion Ozone layer, Standards and control measures.

UNIT IV [7 Hrs]

Different Other Types of Pollutions and Way to their Control, Water Pollution: Natural water, Lake, Arsenic pollution.Land Pollution: Lithosphere, Waste and Waste management, Land filling. Noise Pollution: Causes and Effects.

Suggested Books:

1. Masters, G.M.: “Introduction to Enviromental Engineering”, Pearson Education India.
2. N NBasak: “Environmental Engineering”, McGraw Hill Education.
3. Richard T. Wright, Dorothy F. Boorse: “Environmental Science: Toward a Sustainable Future”, Pearson Education.
4. Eugene Odum.: “Fundamentals of Ecology”,Cengage Learning.
5. Smith:“Elements of Ecology”, Pearson Education India.
6. M. Dash, S. Dash: “Fundamentals Of Ecology”, McGraw Hill Education.

7. N.K. Uberoi:“Environmental Management”, Excel Books.
8. Anil Kumar De and Arnab Kumar De:“Environmental Studies”, New Age International.
9. MahuaBasu and Xavier Savarimuthu SJ: “Fundamentals of Environmental Studies”, Cambridge University Press.
10. AjithSankar: “Environmental Management”, Oxford University Press.
11. R. Rajagopalan:“Environmental Studies”, Oxford University Press.
12. Sindhu P.S.:“Environmental Chemistry”, New Age International.
13. C.K. Varshney: “Water Pollution and Management”, New Age International.
14. Goel P.K.: “Water Pollution: Causes, Effects & Control”, New Age International.
15. Rao C.S.: “Environmental Pollution Control Engineering”, New Age International.

Object Oriented Programming Lab

Code: CSEUGPC07
Contacts: 3P
Credits: 1.5

Course Outcomes:

CO 1: Develop and implement Java programs demonstrating the use of classes, constructors, method overloading, inheritance, and method overriding to solve real-world problems.
CO 2: Create and use abstract classes and perform string manipulation using Java classes such as `String` and `StringBuffer` for robust programming solutions.
CO 3: Utilize wrapper classes and manage arrays effectively in Java to handle various data structures and perform operations.
CO 4: Design and implement Java interfaces to achieve multiple inheritance and extend interfaces to enhance modular programming and software design.
CO 5: Create, access, and manage Java packages to organize code efficiently, demonstrating an understanding of modular programming and effective code reuse.
CO 6: Implement exception handling mechanisms in Java using `try`, `catch`, `throw`, `throws`, and `finally` to create robust, error-free applications.

CO – PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12
CO1	3	2	3	-	2	-	-	-	2	1	-	2
CO2	3	2	2	-	2	-	-	-	2	1	-	2
CO3	3	2	2	-	2	-	-	-	2	-	-	2
CO4	3	3	3	-	2	-	-	-	2	1	-	2
CO5	3	2	2	-	2	-	-	-	2	1	-	2
CO6	3	3	3	2	2	-	-	-	2	1	-	2

1. Assignments on class, constructor, overloading, inheritance, overriding,
2. Assignments on abstract classes, String handling
3. Assignments on wrapper class, arrays
4. Assignments on developing interfaces- multiple inheritance, extending interfaces

5. Assignments on creating and accessing packages
6. Assignments on Exception handling
7. Assignments on multithreaded programming
8. Assignments on applet programming

Suggested Books:

1. E Balagurusamy: "Programming with Java", McGraw Hill Education
2. Herbert Schildt:"Java: The Complete Reference", McGraw Hill Education
3. Sachin Malhotra and Saurabh Choudhary: "Programming in Java", Oxford University Press
4. Y. Daniel Liang: "Introduction to Java Programming, Brief Version", Pearson Education
5. Y. Daniel Liang:"Introduction to Java Programming, Comprehensive Version", Pearson Education
6. Cay S. Horstmann: "Core Java - Vol. I, Vol. II and Vol. II", Pearson Education
7. E. Balagurusamy: "Object-Oriented Programming with C++", McGraw Hill Education
8. Bjarne Stroustrup: "The C++ Programming Language", Pearson Education
9. R. Lafore: "Object Oriented Programming in C++", Pearson Education
10. Debasish Jana: "C++ and Object-Oriented Programming Paradigm", PHI Learning

Computer Organization & Architecture Lab

Code: CSEUGPC08
Contacts: 3P
Credits: 1.5

Course Outcomes:

CO 1: Design different adder circuit and Subtractor circuit.
CO 2: Analyze the functioning of different digital circuits.
CO 3: Use modern tools (Xilinx) to simulate functioning different modules of computer.
CO 4: Apply flip-flop concepts in designing registers.
CO 5: Ability to work in groups

CO – PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12
CO1			3									
CO2		3										
CO3					3							
CO4		3										
CO5									3			

1. Design of adders.
2. Memory module design.
3. Implementation of simple memory test logic (such as March test).
4. Realization of data transfer among CPU registers, Main memory and External sources.

5. Swapping of registers' contents.
6. Control design.
7.Familiarity with IC chips, e.g.
a) Multiplexer , b) Decoder, c) Encoder b) Comparator Truth Table verification and clarification
from Data book.
8. Design a BCD adder.
9. Design of a 'Carry Look Ahead' Adder circuit.
10. Use a multiplexer unit to design a composite ALU.
11. Use ALU chip for multibit arithmetic operation.

Suggested Books:

1. Mano, M.M., "Computer System Architecture", PHI.
2. BehroozParhami: "Computer Architecture", Oxford University Press
3. Hayes J. P.: "Computer Architecture & Organisation", McGraw Hill,
4. Hamacher: "Computer Organisation", McGraw Hill,
5. N. senthil Kumar, M. Saravanan, S. Jeevananthan: "Microprocessors and Microcontrollers" OUP.
6. Chaudhuri P. Pal: "Computer Organisation & Design", PHI.
7. P N Basu: "Computer Organization & Architecture", Vikas Publishing.
8. J. L. Hennessy and D. A. Patterson:"Computer Architecture: A Quantitative Approach", 3rd & 4th ed, Elsevier.
9. Kai Hwang:"Advanced Computer Architecture: Parallelism, Scalability, Programmability", TMH.

Scripting Lab

Code: CSEUGPC09
Contacts: 1T+3P
Credits: 2.5

Course Outcomes:

CO 1: Understand the basics of scripting languages, focusing on the syntax and semantics of Python.
CO 2: Implement control structures, loops, and conditional statements to solve computational problems.
CO 3: Apply data structures such as lists, dictionaries, and tuples in scripting solutions for real-world applications.
CO 4: Develop modular code using functions and libraries, enhancing code reusability and efficiency.
CO 5: Implement object-oriented programming concepts like classes, objects, inheritance, and polymorphism in Python.
CO 6: Handle errors and exceptions efficiently to create robust and error-free scripts.

CO – PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12

CO1	3	2	3	-	2	-	-	-	1	1		1
CO2	3	3	3	1	2	-	-	-	-	1	-	-
CO3	3	3	3	-	3	-	1	-	-	1	-	1
CO4	3	3	3	1	3	2	-	-	-	1	1	-
CO5	2	2	3	1	3	2	1	1	-	-	1	-
CO6	2	2	3	2	3	3	1	1	1	1	1	-

The lab experiments for this course have to ensure that the following concepts of PYTHON LANGUAGE are covered during lab classes:

Introduction: Need of Python Programming, Applications Basics of Python Programming Using the REPL(Shell), Running Python Scripts, Variables, Assignment, Keywords, Input-Output, Indentation.

Types, Operators and Expressions: Types - Integers, Strings, Booleans; Operators-Arithmetic Operators, Comparison (Relational) Operators, Assignment Operators, Logical Operators, Bitwise Operators, Membership Operators, Identity Operators, Expressions and order of evaluations Control Flow- if, if-elif-else, for, while, break, continue, pass

Data Structures Lists - Operations, Slicing, Methods; Tuples, Sets, Dictionaries, Sequences.Comprehensions.

Functions - Defining Functions, Calling Functions, Passing Arguments, Keyword Arguments, Default Arguments, Variable-length arguments, Anonymous Functions, Fruitful Functions(Function Returning Values), Scope of the Variables in a Function - Global and Local Variables.

Modules: Creating modules, import statement, from. Import statement, name spacing, **Python packages** Introduction to PIP, Installing Packages via PIP, Using Python Packages

Object Oriented Programming OOP in Python: Classes, 'self variable', Methods, Constructor Method, Inheritance, Overriding Methods, Data hiding,

Error and Exceptions: Difference between an error and Exception, Handling Exception, try except block, Raising Exceptions, User Defined Exceptions

Brief Tour of the Standard Library - Operating System Interface - String Pattern Matching, Mathematics, Internet Access, Dates and Times, Data Compression, Multithreading, GUI Programming, Turtle Graphics

Testing: Why testing is required ?, Basic concepts of testing, Unit testing in Python, Writing Test cases, Running Tests.

Scripting Languages like Shell, Perl, Java Script; Database Driven Web Site: PHP and MySQL;

Suggested Books:

1. VamsiKurama:“Python Programming: A Modern Approach”, Pearson.
2. Mark Lutz:“Learning Python”,O’Rielly
3. W.Chun: “Core Python Programming”, Pearson.
4. Introduction to Python, Kenneth A. Lambert, Cengage
5. S. Das:“Unix System V.4 Concepts and Applications”, 3rd Ed., Tata Mcgraw-Hill, 2013.
6. D. Flanagan:“Javascript: The Definitive Guide”, 5th Ed., O'Reilly, 2006.
7. D. Gosselin:“PHP Programming with MySQL”, Course Technology, 2006.

Semester V:

Operating Systems

Code: CSEUGPC10
Contacts: 3L
Credits: 3

Course Outcomes:

CO1 Understand the basic concepts of an Operating System (OS):
CO2 Analyze and manage processes in an Operating System:
CO3 Understand and apply CPU scheduling algorithms:
CO4 Implement process synchronization and handle deadlocks:
CO5 Understand memory management and virtual memory techniques:
CO6 Design and manage file systems and I/O operations:
CO7 Evaluate and Implement System Security and Protection Mechanisms:

CO-PO mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3		2								
CO2		3	3									
CO3			3	2								
CO4					3	2						
CO5	3				2	3						
CO6			3					2				
CO7				3					2			

Module-1: [12 Hrs]

Introduction to OS: Introduction to Operating System: Operating system functions, Concept of batch-processing, multi-programmed, time-sharing, real-time, distributed system. Computer system operation, I/O structure, storage structure, storage hierarchy, different types of protections, operating system structure (simple, layered, virtual machine), O/S services, and system calls.

Processes: Concept of processes, state diagram, process control block, scheduling of processes, operations on processes, co-operating processes, inter-process communication.

Threads: overview, benefits of threads, user and kernel threads.

CPU scheduling: scheduling criteria, preemptive& non-preemptive scheduling, scheduling algorithms like FCFS, SJF, RR, Selfish-RR, Priority, Highest Response ratio Next (HRN), and algorithm evaluation, multi-processor scheduling.

Module-2: [12 Hrs]

Process Synchronization: background, critical section problem, critical region, synchronization hardware, semaphores, discussion of synchronization problems like producer-consumer, readers-writers, dining philosophers, sleeping-barber etc.

Deadlocks: conditions, resource allocation graph, deadlock characterization, methods for handling deadlocks, deadlock prevention, deadlock avoidance, deadlock detection, recovery from deadlock.

Memory Management: background, logical vs. physical address space, address translation, swapping, static partitioning, dynamic partitioning, paging, segmentation, segmentation with paging.

Virtual Memory: background, demand paging, performance, page replacement, page replacement algorithms (FIFO, LRU, Optimal page replacement), allocation of frames, thrashing.

Module-3: [12 Hrs]

File Systems: file concept, access methods, directory structure, file system structure, allocation methods (contiguous, linked, and indexed), and free-space management (bit vector, linked list, grouping), directory implementation (linear list, hash table), efficiency & performance.

I/O Management: I/O hardware, polling, interrupts, DMA, application I/O interface, kernel I/O subsystem (scheduling, buffering, caching, spooling and device reservation, error handling), performance.

Disk Management: disk structure, disk scheduling (FCFS, SSTF, SCAN, C-SCAN), disk reliability, disk formatting, boot block, bad blocks, concept of RAID etc.

Protection and Security: Concepts of domain, Access matrix and its implementation, access control, Security of systems- concepts, threats- Trojan horse, virus, worms etc, introduction to cryptography as security tool, user authentication. Case Studies

Suggested Books:

1. A. Silberschatz, P. Galvin and G. Gagne:"Operating Systems Concepts", Wiley India.
2. Gary Nutt, N. Chaki and S. Neogy: "Operating Systems Concepts", Pearson Education.
3. W. Stallings: "Operating Systems", Pearson Education.
4. D. M. Dhamdhere: "Operating Systems: A Concept-based Approach", Tata McGraw-Hill.

Database Management Systems

Code: CSEUGPC11
Contacts: 3L
Credits: 3

Course Outcomes:

CO 1: Understanding the architecture of DBMS and its role in Information System.
CO 2: Mastering SQL queries with background understanding of Relational Algebra and Relational Calculus.
CO 3: Applying E-R model and Relational model for designing and implementation of DBMS.
CO 4: Understanding Integrity Constraint, Functional Dependency and Normalization Rules.
CO 5: Understanding Transaction Processing & Concurrency control.
CO 6: Performing Query Optimization and Evaluation.
CO 7: Understanding indexing, storage structure and recovery management

CO – PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12
CO1	3							1	1			
CO2	2		3		3							
CO3		3	2									
CO4	2		2									
CO5		2	3		1			2				
CO6	3		1	2								
CO7				1								

Introduction [4 Hrs]
Concept & Overview of DBMS, Data Models, Database Languages, Database Administrator, Database Users, Three Schema Architecture of DBMS.

Entity-Relationship Model [4 Hrs]
Basic concepts, Design Issues, Mapping Constraints, Keys, Entity-Relationship Diagram, Weak Entity Sets, Extended E-R features.

Relational Model [5 Hrs]
Structure of relational Databases, Relational Algebra, Relational Calculus, Extended Relational Algebra Operations, Views,Modifications of the Database.

SQL and Integrity Constraints [5 Hrs]
Concept of DDL, DML, DCL. Basic Structure, Set operations, Aggregate Functions, Null Values, Domain Constraints, ReferentialIntegrity Constraints, assertions, Views, Nested Subqueries, Database security application development using SQL, Stored Procedures and Triggers.

Relational Database Design [7 Hrs]
Functional Dependency, Different anomalies in designing a Database., Normalization using functional dependencies, Decomposition, 2NF, 3NF,Boyce-Codd Normal Form, Normalization using multi-valued dependencies, 4NF, 5NF, Lossless Decomposition

Internals of RDBMS [6 Hrs]
Physical data structures, Query optimization: join algorithm, statistics and cost based optimization. Transaction Processing,Concurrency Control and Recovery Management, Serializability, Lock based protocols, Two Phase Locking.

File Organization & Index Structures [5 Hrs]
File & Record Concept, Placing file records on Disk, Fixed and Variable sized Records, Types of Single-Level Index (primary,secondary, clustering), Multilevel Indexes, Dynamic Multilevel Indexes using B tree and B+ tree.

Suggested Books:

1. Abraham Silberschatz, Henry F. Korth and S Sudarshan: “Database System Concepts”, McGraw Hill Education.

2. ElmasriRamez and NovatheShamkant: “Fundamentals of Database Systems”, Pearson Education.
3. Raghu Ramakrishnan and Johannes Gehrke:“Database Management Systems”, McGraw Hill Education
4. Jim Gray and Andreas Reuter:“Transaction Processing: Concepts and Techniques”, Moragan Kauffman Publishers.
5. C.J. Date:“An Introduction to Database Systems”, Pearson Education
6. R. Panneerselvam: “Database Management Systems”, PHI Learning
7. Alexis Leon and Mathews Leon: “Fundamentals of Database Management Systems”, McGraw Hill Education.
8. Ullman JD.: “Principles of Database Systems”, Galgotia Publications.

Design & Analysis of Algorithms

Code: CSEUGPC12
Contacts: 3L+1T
Credits: 4

Course Outcomes:

CO 1: Student will be able to analyze and compare running times of algorithms using asymptotic analysis.
CO 2: Student will be able to demonstrate understanding of algorithmic design paradigms such as divide-and-conquer, dynamic-programming, greedy, backtracking etc. Student will be able to explain suitability of the type of algorithmic design principle needed for a specific problem.
CO 3: Student will be able to employ appropriate data structures like stack /tree /graphs to model engineering problems.
CO 4: Student will be able to understand the notion of computational complexity of problems & advanced concepts

CO – PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12
CO1	2	3		1								
CO2		3	3	2								
CO3				3			2					
CO4			3		2					1		

Module-1 [12 Hrs]

Models of computation:RAM,TM etc. time and space complexity

Asymptotic Notation: Big-O, omega, theta etc.; finding time complexity of well known algorithms like heap sort, search algorithm etc.

Algorithm design techniques:. Recursion: use, limitations, examples.

Divide and Conquer: basic concept, use, examples (Merge sort, Quick Sort, Binary Search).

Module-2 [12 Hrs]

Dynamic Programming: basic concept, use, examples (matrix-chain multiplication, all-pair shortest paths, single-source shortest path, travelling salesman problem).

Branch and Bound: basic concept, use, examples (15-puzzle problem).

Backtracking: basic concept, use, examples (Eight queens problem, graph coloring problem, Hamiltonian problem).

Greedy Method: basic concept, use, examples (Knapsack problem, Job sequencing with deadlines, minimum spanning tree).

Lower Bound Theory: Bounds on sorting and sorting techniques using partial and total orders.

Disjoint Set Manipulation: Set manipulation algorithm like UNION-FIND, union by rank, Path compression.

Module-3 [12 Hrs]

Properties of graphs and graph traversal algorithms: BFS and DFS.

Matrix manipulation algorithms: Different types of algorithms and solution of simultaneous equations, DFT & FFT algorithm; integer multiplication schemes.

Notion of NP-completeness: P class, NP-hard class, NP-complete class, Circuit Satisfiability problem, Clique Decision Problem.

Approximation algorithms: Necessity of approximation scheme, performance guarantee, Polynomial time approximation schemes: 0/1 knapsack problem.

Suggested Books:

1. T.H. Cormen, C.E. Leiserson, R.L. Rivest, C. Stein: "Introduction to Algorithms", The MIT Press.
2. E. Horowitz, S. Sahni, S. Rajasekaran: "Fundamentals to Computer Algorithms", Springer.
3. C.H. Papadimitriou, E. Steiglitz:"Combinatorial Optimization Algorithms and Complexity", Dover Publications Inc.

Formal Language & Automata Theory

Code: CSEUGPC13
Contacts: 3L+1T
Credits: 4

Course Outcomes:

CO 1: Understand the fundamental concepts of formal languages, grammars, and automata theory, including Chomsky hierarchy, regular expressions, and finite automata.
CO 2: Analyze and design deterministic and non-deterministic finite automata (DFA & NFA), and prove equivalence between them and regular expressions.
CO 3: Understand context-free languages (CFLs), context-free grammars (CFGs), and pushdown automata (PDA), and apply pumping lemmas to CFLs.
CO 4: Explore context-sensitive languages (CSLs) and linear bounded automata (LBA), understanding their properties and equivalence.
CO 5: Study Turing machines (TMs), undesirability, the Church-Turing thesis, and the halting problem, analyzing their implications for computability.

CO – PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12
CO1	3	2	3		2	3	2					2
CO2	3	3	2	3	2	3	2					2
CO3	3	2	3	2	2	3	2					2
CO4	3	2	3	2	3	2	2					2
CO5	3	2	3	3	2	3	2	3	3	2	3	3

Module-1 [12 Hrs]

Introduction: Alphabet, Languages, Grammars, Productions, Derivation, Chomsky hierarchy of languages, Regular Expressions and Languages. [3L]

Finite Automata (FA): Deterministic finite automata (DFA), Non-deterministic finite automata (NFA), Deterministic finite automata (DFA) and equivalence with regular expressions, nondeterministic finite automata (NFA) and equivalence with DFA, regular grammars and equivalence with finite automata, Minimization of Finite Automata. [6L]

Regular Languages: Regular Sets and Languages, Properties of Regular Languages, Pumping Lemma for Regular Languages. [3L]

Module-2 [12 Hrs]

Context-Free Languages and Pushdown Automata: Context-free grammars (CFG) and languages (CFL), Chomsky and Greibach normal forms, nondeterministic pushdown automata (PDA) and equivalence with CFG, parse trees, ambiguity in CFG, pumping lemma for context-free languages, deterministic pushdown automata, closure properties of CFLs. [8L]

Context-Sensitive Languages: Context-sensitive grammars (CSG) and languages, linear bounded automata and equivalence with CSG. [4L]

Module-3 [12 Hrs]

Turing machines: The basic model for Turing machines (TM), Turing-recognizable (recursively enumerable) and Turing-decidable (recursive) languages and their closure properties, Variants of Turing machines, Nondeterministic TMs and equivalence with deterministic TMs, Universal TMs, Halting Problem, Recursive Functions and Sets, Recursively Enumerable Sets, unrestricted grammars and equivalence with Turing machines, TMs as enumerators. [8L]

Undecidability: Church-Turing Thesis, Universal Turing Machine, The Universal And

Diagonalization Languages, Reduction Between Languages And Rice's Theorem, Undecidable Problems About Languages. [4L]

Suggested Books:

1. John Martin: "Introduction to Languages and Theory of Computation",Tata McGraw Hill.
2. J. E. Hopcroft and J. D. Ullman:"Introduction to Automata Theory, Languages and Computation", Pearson Education.
3. H. R. Lewis and C. H. Papadimitriou:"Elements of the Theory of Computation", Second Edition, Pearson Education.
4. Peter Linz:"An Introduction to Formal Languages and Automata", Narosa.
5. Michael Sipser:"Introduction to the Theory of Computation", Thomson Press.
6. Dexter C. Kozenm:"Automata and Computability", Springer.

Operating Systems Lab

Code: CSEUGPC14
Contacts: 3P
Credits: 1.5

Course Outcomes:

CO 1: Develop Shell Scripts
CO 2: Manage Processes in an Operating System
CO 3: Handle Signals in Unix/Linux
CO 4: Implement Synchronization Using Semaphores
CO 5: Implement Multi-threading with POSIX Threads
CO 6: Master Inter-process Communication (IPC) using Pipes and FIFOs

CO-PO mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**3**		**2**									
CO2	**3**		**2**									
CO3			**2**		**3**							
CO4		**3**	**2**									
CO5	**3**		**2**									
CO6		**3**			**2**							

1. **Shell programming:** creating a script, making a script executable, shell syntax (variables, conditions, control structures, functions, commands).
2. **Process:** starting new process, replacing a process image, duplicating a process image, waiting for a process, zombie process.
3. **Signal:** signal handling, sending signals, signal interface, signal sets.
4. **Semaphore:** programming with semaphores (use functions semctl, semget, semop, set_semvalue, del_semvalue, semaphore_p, semaphore_v).

5. **POSIX Threads:** programming with pthreadfunctions(viz. pthread_create, pthread_join, pthread_exit, pthread_attr_init, pthread_cancel)
6. **Inter-process communication:**pipes(use functions pipe, popen, pclose), named pipes(FIFOs, accessing FIFO)

Suggested Books:

1. UNIX concepts and Applications, Sumitabha Das, 4th Edition, Tata McGraw-Hill
2. Introduction to UNIX SHELL Programming, M.G. Venkateshmurthy, Pearson Education
3. UNIX and SHELL Programming, B.M. Harwani, Oxford Higher Education

Database Management Lab

Code: CSEUGPC15
Contacts: 3P
Credits: 1.5

Course Outcome:

CO 1: Design and Implement a database schema
CO 2: Devise queries using DDL, DML, DCL and TCL commands.
CO 3: Applications using PL/SQL
CO 4: Design and implement a project using SQL and Programming Language.

CO – PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12
CO1	1		3									
CO2			2	1	3							
CO3	1		2	1								
CO4		3	3	2					2			

Overview of Structured Query Language

1. **Creating Database**
   - Creating a Database
   - Creating a Table
   - Specifying Relational Data Types
   - Specifying Constraints
   - Creating Indexes

2. **Table and Record Handling**
   - INSERT statement
   - Using SELECT and INSERT together
   - DELETE, UPDATE, TRUNCATE statements
   - DROP, ALTER statements

3. **Retrieving Data from a Database**
   - The SELECT statement

- Using the WHERE clause
- Using Logical Operators in the WHERE clause
- Using IN, BETWEEN, LIKE , ORDER BY, GROUP BY and HAVING

4. **Clauses**
   - Using Aggregate Functions
   - Combining Tables Using JOINS
   - Subqueries

5. **Database Management**
   - Creating Views
   - Creating Column Aliases
   - Creating Database Users
   - Using GRANT and REVOKE

6. **Cursors in Oracle PL / SQL**

7. **Writing Oracle PL / SQL Stored Procedures**

References:

1. Oracle PL/SQL by example, by Rosenzweig, Pearson Publication
2. Practical Oracle SQL, by Kim Berg Hansen, Oreilly Publication

Design & Analysis of Algorithms Lab

Code: CSEUGPC16
Contacts: 3P
Credits: 1.5

Course Outcome:

CO 1: To analyze the complexities of various problems in different domains.
CO 2: To prove the correctness and analyze the running time of the basic algorithms for those classic problems in various domains.
CO 3: To understand methods for analyzing the efficiency and correctness of algorithms (such as exchange arguments, recurrence, induction, and average case analysis).
CO 4: To design algorithms using the dynamic programming, greedy method, Backtracking, Branch and Bound strategy, and recite algorithms that employ this strategy.
CO 5: To compare, contrast, and choose appropriate algorithmic design techniques to present an algorithm that solves a given problem.

CO – PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12
CO1	3	2										
CO2		3	2			2					1	
CO3				3	2	2						1

CO4		**2**	**3**		**3**						**1**	
CO5			**2**	**3**					**2**			**1**

1. Implement Binary Search using Divide and Conquer approach
2. Implement Merge Sort using Divide and Conquer approach
3. Sort a given set of elements using the Heap sort method and determine the time taken to sort the elements
4. Sort a given set of elements using Selection sort and hence find the time required to sort elements.
5. Implement Quick Sort using Divide and Conquer approach
6. Find Maximum and Minimum element from an array of integer using Divide and Conquer approach
7. Obtain the Topological ordering of vertices in a given digraph
8. Find the minimum number of scalar multiplication needed for chain of matrix
9. Implement all pair of shortest path for a graph (Floyed- Warshall Algorithm)
10. Implement Traveling Salesman Problem
11. Implement Single Source shortest Path for a graph (Dijkstra, Bellman Ford Algorithm)
12. Implement 15 Puzzle Problem
13. Implement 8 Queen problem
14. Minimum Cost Spanning Tree by Prim's Algorithm >Minimum Cost Spanning Tree by Kruskal's Algorithm
15. Implement Breadth First Search (BFS) >Implement Depth First Search (DFS)

Suggested Books:

1. T.H. Cormen, C.E. Leiserson, R.L. Rivest, C. Stein: "Introduction to Algorithms", The MIT Press.
2. E. Horowitz, S. Sahni, S. Rajasekaran: "Fundamentals to Computer Algorithms", Springer.
3. C.H. Papadimitriou, E. Steiglitz: "Combinatorial Optimization Algorithms and Complexity", Dover Publications Inc.

Semester VI:

Software Engineering

Code: CSEUGPC17
Contacts: 3L
Credits: 3

Course Outcomes:

CO 1: Understand the fundamental concepts of software engineering, different software development process models, and requirements engineering techniques.
CO 2: Design software systems using structured and object-oriented approaches, and apply techniques for modular design, coding standards, and documentation.
CO 3: Apply various software testing techniques, including test case generation, regression testing, and model-based testing to ensure the correctness and quality of the software.
CO 4: Manage software projects effectively, including project estimation, scheduling, and configuration management using quality assurance methodologies.
CO 5: Understand and apply software development modeling techniques such as UML,

DFD, ERD, and use CASE tools in designing concurrent and distributed systems.

CO – PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12
CO1	3	2	2	2	3	3	2	2		2		2
CO2	3	3	3	3	3	2	3			2	3	2
CO3	2	2	3	3	3	3	2	3		2	3	2
CO4	3	3	3	23	3	3	2			3	3	2
CO5	3	3	2		3	2	3	2	3	2	3	2

Module 1:[12 Hrs]

Software as an engineering product, Software vs. Program, Software engineering vsconventional engineering, Goals of software engineering, Issues and challenges.

Software development process models, Waterfall, Prototyping, Spiral, Incremental, RAD and Component based development model; Comparative analysis.

Requirement Engineering - Tools for requirement elicitation and analysis, Analysis issues,System Requirement Specification, Formal techniques– Z Spec, Analysis Models forStructured approach &Object Oriented approach, Requirement Traceability.

Module 2:[12 Hrs]

Software Design &Modelling - Problem partitioning, Top-Down And Bottom-Up design,Structured charts, coupling,cohesion, Modular Design and Structured Programming. Data design, User Interface design.

Coding & Documentation: Coding Standards and Guidelines, Code review &walkthrough,Structured Programming, OO Programming, Information Hiding, Code reuse, System Documentation.

Software testing objectives and principles, Verification vs. Validation, Types of testing,Cyclomatic complexity, Test Case Generation, Test tools & Models, Object-orientedTesting, Model Based testing, Test automation, Regression.

Module 3:[12 Hrs]

Software Project Management: Project Scheduling, Staffing, Software Configuration Management, Quality Assurance, Qualityfactors, Quality standards – TQM, ISO, SEI CMM, PCMM, Six sigma, Reliability;Project Monitoring; Software Project Estimation - Estimation Metrics- Size Oriented andFunction Point Oriented; Cost Estimation - Algorithmic Cost Modeling, COCOMO, advanced COCOMO, Personnel Productivity &team structure.

Overview of models in software development – UML, DFD, ERD, Modeling concurrent& distributed systems - PetriNets, High Level Petri Nets;

CASE tools: Concepts, use and application.

Suggested Books:

1. C. Ghezzi, M. Jazayeri, D. Mandrioli: “Fundamentals of Software Engineering”,Pearson.
2. Sommerville: “Software Engineering”, Pearson.
3. Martin L. Shooman: “Software Engineering”, TMH.
4. Roger Pressman: “Software Engineering - A practitioner’s approach”, Mcgraw-Hill Companies, Inc.
5. Rajib Mall: “Software Engineering”, PHI.

Compiler Design

Code: CSEUGPC18
Contacts: 3L
Credits: 3

Course Outcomes:

CO 1: Describe the fundamental concepts and phases of a compiler, including lexical, syntax, and semantic analysis.
CO 2: Apply techniques for lexical analysis, including regular expressions, finite automata, and token recognition.
CO 3: Develop syntax analysis techniques such as LL, SLR, and LALR parsing and understand syntax-directed translation.
CO 4: Implement type checking mechanisms and explain runtime environments, including activation records, scope management, and memory allocation strategies.
CO 5: Generate intermediate code representations and manage code generation, including control flow and register allocation.
CO 6: Apply basic optimization techniques to improve code performance by reducing redundancies and optimizing loops.

CO – PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12
CO1	3	2	-	-	-	-	-	-	-	-	-	-
CO2	3	3	2	-	-	-	-	-	-	-	-	-
CO3	3	3	3	2	-	-	-	-	-	-	-	-
CO4	3	3	2	2	-	-	-	-	-	-	-	-
CO5	3	3	3	2	2	-	-	-	-	-	-	-
CO6	3	3	2	2	2	-	-	-	-	-	-	-

Module-1 [8 Hrs]
Introduction to Compiling [2L]
Compilers, Analysis-synthesis model, The phases of the compiler, Cousins of the compiler.
Lexical Analysis [6L]
The role of the lexical analyzer, Tokens, Patterns, Lexemes, Input buffering, Specifications of tokens, Recognition of tokens, Finite automata, From a regular expression to NFA, From a regular expression to DFA, Design of a lexical analyzer generator (Lex).

Module-2 [10 Hrs]
Syntax Analysis [6L]
The role of a parser, Context free grammars, Writing a grammar, Top down Parsing, Non-recursive Predictive parsing (LL), Bottom up parsing, Operator precedence parsing, LR parsers (SLR, LALR), Parser generators (YACC). Error Recovery strategies for different parsing techniques.
Syntax directed translation [4L]
Syntax directed definitions, Construction of syntax trees, Bottom-up evaluation of S attributed definitions, L attributed definitions, Top-down translation, Bottom-up evaluation of inherited attributes.

Module-3 [8 Hrs]
Type checking [3L]

Type systems, Specification of a simple type checker, Equivalence of type expressions, Type conversions, Overloading of functions and operators.

Run time environments [5L]

Source language issues (Activation trees, Control stack, scope of declaration, Binding of names), Storage organization (Subdivision of run-time memory, Activation records), Storage allocation strategies, Parameter passing (call by value, call by reference, copy restore, call by name), Symbol tables, dynamic storage allocation techniques.

Module-4 [10 Hrs]

Intermediate code generation [3L]

Intermediate languages - Graphical representation, Three-address code, Implementation of three address statements (Quadruples, Triples, Indirect triples), Declarations, Assignment statements, Boolean expressions.

Code generations [4L]

Issues in the design of code generator, The target machine, Run-time storage management, Basic blocks and flow graphs, A simple code generator, Register allocation and assignment, The DAG representation of basic blocks, Peephole optimization.

Code optimization [3L]

Introduction, The principle sources of optimization, Optimization of basic blocks, Loops in flow graphs.

Suggested Books:

1. Aho, Sethi, Ullman: “Compiler Principles, Techniques and Tools”, Pearson Education.
2. K. V. N. Sunitha: “Compiler Construction”, Pearson Education.
3. O.G. Kakde: “Compiler Design”, Laxmi Publications.
4. Holub: “Compiler Design in C”, PHI.
5. Tremblay and Sorenson: “Compiler Writing”, McGrawHill International.
6. Chattopadhyay: “Compiler Design”, PHI.

Computer Networks

Code: CSEUGPC19
Contacts: 3L
Credits: 3

Course Outcomes:

CO1 Understand the Basics of Data Communication and Networking
CO2 Explore and Compare Network Protocols and Standards
CO3 Analyze and Implement Data Link Layer Functions
CO4 Master Medium Access Control and Network Layer Protocols
CO5 Develop a Strong Understanding of Routing Protocols and Algorithms
CO6 Understand Transport Layer Protocols and Quality of Service
CO7 Gain Knowledge of Network Security, Wireless LANs, and Emerging Technologies

CO-PO mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12
CO1	3	2										

CO2	**3**			**2**								
CO3		**3**	**2**									
CO4			**3**	**2**								
CO5	**3**			**2**								
CO6	**3**					**2**						
CO7					**3**				**2**			

Module-1: [12 Hrs]

Introduction: Data communications concepts, direction of data flow (simplex, half duplex, full duplex). Networks: physical structure (type of connection, topology), categories of network (LAN, MAN, WAN). Internet: brief history, internet today. Protocols and standards; Reference models: OSI reference model, TCP/IP reference model, their comparative study.

Physical level: Overview of data (analog & digital), review of signal (analog & digital), transmission (analog & digital) & transmission media (guided & non-guided). TDM, FDM, WDM. Circuit switching and packet switching concepts

Data link layer: Types of errors, framing (character and bit stuffing), error detection & correction methods; Flow control; Protocols: Stop & wait ARQ, Go-Back-N ARQ, Selective repeat ARQ, HDLC.

Module-2: [12 Hrs]

Medium access sub layer: Point to point protocol, token bus, token ring. Multiple access protocols: Pure ALOHA, Slotted ALOHA, CSMA, CSMA/CD. Traditional Ethernet, Fast Ethernet.

Network layer: Internetworking & devices: Repeaters, Hubs, Bridges, Switches, Router. Addressing: Internet address, classful and classless addressing, subnetting.
Routing: techniques, static vs. dynamic routing, routing table for classful address.
Routing algorithms: shortest path algorithm, flooding, distance vector routing, link state routing. Protocols: ARP, RARP, IP, ICMP, IPV6. Unicast and multicast routing protocols.

Module-3: [12 Hrs]

Transport layer: Process to process delivery, UDP, TCP, Congestion control algorithms. Quality of service, techniques to improve QoS.

Application layer:DNS, SMTP, SNMP, FTP, HTTP & WWW.
Security: cryptography, user authentication, security protocols in internet, Firewalls.

Wireless LAN: IEEE 802.11; Introduction to Bluetooth, VLAN's, Cellular telephony & Satellite network.

Suggested Books:

1. B. A. Forouzan: "Data Communications and Networking (3rd Ed.)", TMH.
2. A. S. Tanenbaum: "Computer Networks (4th Ed.)", Pearson Education/PHI.
3. W. Stallings: "Data and Computer Communications (5th Ed.)", PHI/ Pearson Education.
4. Zheng&Akhtar:"Network for Computer Scientists & Engineers", OUP.
5. Black, Data & Computer Communication", PHI.
6. Miller: "Data Communication & Network", Vikas.
7. Miller:"Digital& Data Communication", Jaico.
8. Shay:"Understanding Data Communication & Network", Vikas.

Computer Graphics

Code: CSEUGPC20
Contacts: 3L
Credits: 3

Course Outcomes:

CO 1: Knowledge about the foundations of computer graphics.
CO 2: Concepts about geometric/mathematical transforms and other algorithms necessary for programming computer graphics.
CO 3: Understanding of object representation and viewing in display devices.
CO 4: Knowledge about illumination, ray tracing, animation, etc.
CO 5: Familiarity with different aspects and components about recent applications of computer graphics and insights into upcoming prospective graphics-powered applications.

CO – PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12
CO1	3		1		1	1	2		1		1	
CO2	1	1	3	1	1	1	1		1		2	1
CO3	1	1	1	1	3	1	2		1		1	1
CO4	1	1	2	1	1	1	3		2		1	1
CO5	1	1	1	1	2	1	1		1		3	1

Unit I. Introduction to Computer Graphics & Graphics Systems [5 Hrs]
Overview of computer graphics, graphical display devices, representing pictures, preparing, presenting & interacting with pictures for presentations; Visualization & image processing; RGB color model, direct coding, lookup table; storage tube graphics display, Raster scan display, 3D viewing devices, Plotters, printers, digitizers, Light pens etc.; Active & Passive graphics devices; Computer graphics softwares; Character generation

Unit II. Scan Conversion [6 Hrs]
Points and lines, Line drawing algorithms; DDA algorithm, Bresenham's line algorithm, Circle generation algorithm; Ellipse generating algorithm; scan line polygon fill algorithm, boundary fill algorithm, flood fill algorithm.

Unit III. 2D Transformation [4 Hrs]
Basic transformations - translation, rotation, scaling; Matrix representations & homogeneous coordinates, transformations between coordinate systems; reflection, shear, Transformation of points, lines, parallel lines, intersecting lines.

Unit IV. Viewing in 2D [4 Hrs]
Viewing pipeline, Window to viewport co-ordinate transformation, clipping operations, point clipping, line clipping, Cohen Sutherland Algorithm, clipping circles, polygons & ellipse, Sutherland Hodgeman algorithm.

Unit V. 3D Transformation and Viewing [4 Hrs]
Translation, rotation, scaling & other transformations, Rotation about an arbitrary axis in space, reflection through an arbitrary plane; general parallel projection transformation; clipping, viewport clipping, 3D viewing.

Unit VI. Curves and Surfaces [5 Hrs]

Object representation; Curve and surface designs, Bezier curves, Continuity conditions; B-spline curves, end conditions for periodic B-spline curves, rational B-spline curves.

Unit VII. Hidden Surfaces [4 Hrs]
Depth comparison, Z-buffer algorithm, Back face detection, BSP tree method, the Printer's algorithm, scan-line algorithm; Hidden line elimination, wire frame methods, fractal - geometry.

Unit VIII. ColorandShadingModels [4 Hrs]
Light andcolor model; interpolative shading model; Texture; Ray tracing; Animation

Suggested Books:

1. D. Hearn and M.P. Baker: "Computer Graphics C version", Pearson Education.
2. Samit Bhattacharya: "Computer Graphics", Oxford University Press.
3. David F.Rogers: "Procedural Elements for Computer Graphics", TMHpublication.
4. David F. Rogers and J. A.Adams: "Mathematical Elements for Computer Graphics", TMH publication.
5. J.D. Foley, A. van Dam, S.K.Feiner and F. H. John: "Computer Graphics Principles &Practice in C", Pearson.
6. S. Harrington: "Computer Graphics – A Programming Approach", TMHpublication.
7. A.N. Sinha and A.D. Udai: "Computer Graphics", TMH publication.

Embedded Systems

Code: CSEUGPC21
Contacts: 3L
Credits: 3

Course Outcomes:

CO 1: Analyze the characteristics of different computing elements and select the most appropriate one for an embedded system.
CO 2: Simulate the operation of a given embedded system.
CO 3: Analyze the role of different software modules in the development of an embedded system.
CO 4: Develop simple tasks to run on an RTOS.
CO 5: Examine the latest trends prevalent in embedded system design.

CO – PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12
CO1		3										
CO2				3								
CO3		3	2									
CO4			3									
CO5				3								

UNIT -I: [6 Hrs]

Introduction to Embedded Systems:
Definition of Embedded System, Embedded Systems Vs General Computing Systems, History of Embedded Systems, Classification, Major Application Areas, Purpose of Embedded Systems, Characteristics and Quality Attributes of Embedded Systems.

UNIT -II:[8 Hrs]

Typical Embedded System:
Core of the Embedded System: General Purpose and Domain Specific Processors, ASICs, PLDs, Commercial Off-The-Shelf Components (COTS), Memory: ROM, RAM, Memory according to the type of Interface, Memory Shadowing, Memory selection for Embedded Systems, Sensors and Actuators, Communication Interface: Onboard and External Communication Interfaces.

UNIT -III:[5 Hrs]

Embedded Firmware:
Reset Circuit, Brown-out Protection Circuit, Oscillator Unit, Real Time Clock, Watchdog Timer, Embedded Firmware Design Approaches and Development Languages.

UNIT -IV:[6 Hrs]

RTOS Based Embedded System Design:
Operating System Basics, Types of Operating Systems, Tasks, Process and Threads, Multiprocessing and Multitasking, Task Scheduling.

UNIT -V:[5 Hrs]

Task Communication:
Shared Memory, Message Passing, Remote Procedure Call and Sockets, Task Synchronization: Task Communication/Synchronization Issues, Task Synchronization Techniques, Device Drivers, How to Choose an RTOS.

UNIT –VI:[6 Hrs]

8051, AVR, PIC, ARM Microcontroller Interfacings with:
LEDs and LCD,DC Motor and Stepper Motor, Switches and Relays ,HEX Keypad,ADC CENTRE

Suggested Books:

1. Shibu K.V: “Introduction to Embedded Systems”, Mc Graw Hill.
2. Raj Kamal: “Embedded Systems”, TMH.
3. Frank Vahid, Tony Givargis,: “Embedded System Design”, Wiley.
4. Lyla: “Embedded Systems”, Pearson, 2013.
5. David E. Simon: “An Embedded Software Primer”, Pearson Education.

ELECTIVE – I

Bioinformatics

Code: CSEUGPE01
Contacts: 3L
Credits: 3

Course Outcomes:

CO 1: Demonstrate knowledge of computational biology's role and the basic methods of sequence assembly and alignment.
CO 2: Utilize biological databases effectively for data retrieval and analysis in genomics and proteomics research.
CO 3: Apply phylogenetic methods for constructing evolutionary relationships and understand sequence evolution models.
CO 4: Implement clustering algorithms and interpret gene expression data to identify biological patterns.
CO 5: Model biological networks using computational approaches and analyze network structures for insights into biological processes.
CO 6: Employ machine learning techniques for modeling complex biological data and extracting meaningful insights.

CO – PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12
CO1	3	3	2	2	2	-	-	-	1	1	-	2
CO2	3	2	2	2	2	-	-	-	1	1	-	2
CO3	3	3	3	3	2	-	-	-	2	1	-	2
CO4	3	3	3	3	2	-	-	-	2	1	-	2
CO5	3	3	3	3	3	-	-	-	2	1	-	2
CO6	3	3	3	3	3	-	-	-	2	1	2	3

Module-1 [12 Hrs]

Background: Why computational biology, biological information, challenges in computational biology.

Sequence Assembly: Fragment assembly, Sequencing by hybridization, Overlap-layout-consensus

Sequence Alignment: Introduction to biological sequences, DNA sequence, dynamic programming methods for global and local alignment, gap penalty functions, heuristics in alignment, BLAST, pairwise sequence alignment, multiple sequence alignment

Module-2 [12 Hrs]:

Biological Database and its Types: Introduction to data types and Source. Population and sample, Classification and Presentation of Data.Quality of data, private and public data sources.General Introduction of Biological Databases; Nucleic acid databases (NCBI, DDBJ,

and EMBL). Protein databases (Primary, Composite, and Secondary). Specialized Genome databases: (SGD, TIGR, and ACeDB). Structure databases (CATH, SCOP, and PDBsum)

Phylogenetic Trees: Distance, parsimony, and probabilistic methods of phylogenetic tree construction, models of sequence evolution

Module-3 [12 Hrs]
Clustering approaches to biological datasets: High-throughput technologies, clustering algorithms, evaluation of clusters.

Gene Expression analysis: Representation of patterns and relationship General introduction to Gene expression in prokaryotes and eukaryotes, transcription factors binding sites. SNP, EST, STS. Introduction to Regular Expression, Hierarchies, and Graphical models (including Marcov chain and Bayes notes).Genetic variability and connections to clinical data**.**

Modelling and analysis of biological networks: Biological networks, computational problems in network biology, Bayesian networks, module networks, parameter and structure learning, regression-based network inference, network applications.

Machine Learning algorithms and its usage in modelling biological data.

Suggested Books:

1. JIN XIONG: "Essential Bioinformatics", Cambridge University Press.
2. Joachim Selbig and Stefanie Hartmann: "Introductory Bioinformatics: Fourth Edition",
3. Jonathan Pevsner: "Bioinformatics and Functional Genomics", Wiley- Blackwell.
4. S.C. Rastogi, N Mendiratta, P Rastogi: "Bioinformatics: Methods & Applications", PHI.
5. Stanley I. Letovsky: "Bioinformatics: Databases and Systems", Springer.
6. SorinDraghici: "Bioinformatics Databases: Design, Implementation, and Usage (Chapman & Hall/ CRC Mathematical Biology & Medicine)",
7. Arthur M.Lesk: "Data base annotation in molecular biology, Principles and Practices", Wiley.
8. Tao, Jiang, Ying Xu, Michael Q. Zang: "Current topics in computational molecular biology", Ane Books Pvt. Ltd (2004).

Data Science & Big Data

Code: CSEUGPE02
Contacts: 3L
Credits: 3

Course Outcomes:

CO 1: Understand the fundamentals of data definitions, categorization, and statistical learning, and apply R programming for data management and analysis.

CO 2: Apply descriptive statistics, hypothesis testing, and statistical analysis techniques using R to derive insights from data.

CO 3: Perform regression, classification, clustering, and association rule analysis, utilizing R for data analysis and visualization.

CO 4: Comprehend the principles of big data, Hadoop framework, and MapReduce job execution to process large-scale data.

CO 5: Apply data science techniques to real-world case studies and projects, including feature engineering, parallel computing, and data visualization for effective decision-making.

CO – PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12
CO1	3	2			3				2	2		3
CO2	3	3		2	3	2			2	2		2
CO3	3	3	3	3	3	2				3	2	3
CO4	3	2	3	3	3	3			3	2	3	2
CO5	3	3	3	3	3	2			3	3	3	3

Unit I. Data Definitions and Analysis Techniques [6 hrs]
Elements, Variables, and Data categorization; Levels of Measurement; Data management and indexing; Introduction to statistical learning and R-Programming

Unit II. Descriptive Statistics and Basic AnalysisTechniques[8 Hrs]
Measures of central tendency; Measures of location of dispersions; Practice and analysis with R; Statistical hypothesis generation and testing; Chi-Square test; t-Test; Analysis of variance; Correlation analysis; Maximum likelihood test; Practice and analysis with R

Unit III. Data Analysis Techniques [10 Hrs]
Relation analysis; Regression analysis; Classification techniques; Clustering; Association rules analysis; Practice and analysis with R

Unit IV. Big Data Processing [8 Hrs]
Big data concepts; Introduction to Hadoop; Hadoop Distributed File System; Anatomy of a Map Reduce Job Run, Failures, Job Scheduling, Shuffle and Sort, Task Execution, Map Reduce Typesand Formats, Map Reduce Features; Hadoop EcoSystem

Unit V. Case Studies and Projects [4 Hrs]
Understanding business scenarios; Feature engineering and visualization; Scalable and parallel computing with Hadoop and Map-Reduce; Sensitivity Analysis

Suggested Books:

1. Joel Grus: “Data Science from Scratch”, O’Reilly Publisher.
2. R. Myers and R. Walpole: “Probability and Statistics for Engineers and Scientists”, Pearson.
3. Seema Acharya and SubhasiniChellappan: “Big Data Analytics”, Wiley Publisher.
4. Tom White: “Hadoop: The Definitive Guide”, O’Reilly Publisher.

Image Processing

Code: CSEUGPE03
Contacts: 3L
Credits: 3

Course Outcomes:

CO 1: Understand the fundamental concepts of image formation, camera models, and imaging systems, and apply calibration techniques for monocular and binocular systems.
CO 2: Describe the fundamentals of digital images, color models, and the process of image digitization, including sampling and quantization.
CO 3: Apply spatial and frequency domain techniques for image enhancement, including filtering, histogram equalization, and transform methods such as Fourier and Wavelet transforms.
CO 4: Utilize morphological operations for image processing, including dilation, erosion, and basic algorithms for gray-scale images.
CO 5: Implement techniques for image segmentation, feature extraction, and object recognition using methods like edge detection, Hough transform, and principal component analysis.
CO 6: Analyze various image compression techniques and models, both error-free and lossy, to optimize image storage and transmission.

CO – PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12
CO1	3	2			2					2		2
CO2	3	2			3				2			3
CO3	3	3	3	3	3				2	2	2	3
CO4	3	3	2		3					2		2
CO5	3	3	3	3	3	2				3	2	3
CO6	3	2		2	3				3	3	2	2

Module - 1 [3 Hrs]
Image formation: Monocular imaging system, Orthographic & Perspective Projection, Camera model and Camera calibration, Binocular imaging systems.
Module - 2 [4 Hrs]
Introduction: Overview of Image Processing System, Image Digitization (Sampling and Quantization), Digital Image, Fundamentals of Color image, Color Models (RGB, YCbCr, HIS), Image File Format.
Module - 3 [3 Hrs]
Spatial Domain Image Enhancement: Contrast Intensification (linear and non-linear stretching), Histogram Equalization, Spatial Domain Smoothing and Sharpening Filters, Correlation and Convolution.
Module - 4 [4 Hrs]
Frequency Domain Image Enhancement: Fourier Transform (1-D and 2-D), Frequency Domain image, Image smoothing, Image sharpening, Correlation and Convolution, Discrete Cosine Transform, Discrete Wavelet Transform.
Module - 5 [3 Hrs]

Morphological Image Processing: Dilation and Erosion, Opening and Closing, Some Basic Morphological Algorithms, Extensions to Gray-Scale Images.

Module - 6 [5 Hrs]

Image Segmentation: Point Detection, Line Detection, Edge Detection**,** Edge Linking and Edge Following by Local Processing, Hough Transform, Thresholding, Region segmentation

Module - 7 [9 Hrs]

Image Representation, Feature Extraction & Object Recognition: Boundary Representation by Chain Codes, Polygonal Approximation, Skeletons Component Labeling and Counting Geometrical, Texture Analysis, Geometric Moments Texture Descriptor, Gray-level Co Occurrence Matrix, some object recognition methods, Shape correspondence and shape matching, Principal Component analysis, Shape priors for recognition, Texture Description, Pattern & Pattern Classes, Template Matching.

Module - 8 [5 Hrs]

Image Compression: Fundamentals, Compression Models, Error-Free compression, Lossy Compression.

Suggested Books:

1. Rafael C. Gonzalez and Richard E. Woods, "Digital Image Processing".
2. B. Chanda and D. Dutta Majumder, "Digital Image Processing and Analysis".
3. D. Forsyth and J. Ponce , "Computer Vision - A modern approach", Prentice Hall.

VLSI Design

Code: CSEUGPE04
Contacts: 3L
Credits: 3

Course Outcomes:

CO 1: Comprehend the circuit design issues in the context of VLSI technology.

CO 2: Use mathematical methods and circuit analysis models in analysis of CMOS digital electronics circuits, including logic components and their interconnection.

CO 3: Create models of moderately sized CMOS circuits that realize specified digital functions.

CO 4: Apply CMOS technology-specific layout rules in the placement and routing of transistors and interconnect, and to verify the functionality, timing, power, and effects.

CO 5: Have an understanding of the characteristics of CMOS circuit construction and the comparison between different state-of-the-art CMOS technologies and processes.

CO – PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12
CO1	2	3		2	2							
CO2			2		3				2			
CO3	2		3								2	
CO4		3			2	3						

CO5	3	1			2					2		

UNIT –I:
MOS, CMOS, BiCMOS Technology.
Basic Electrical Properties of MOS, CMOS &BiCMOS Circuits: Ids – Vds relationships, Threshold Voltage VT, Gm, Gds and ωo, Pass Transistor, MOS, CMOS & Bi CMOS Inverters, Zpu/Zpd, MOS Transistor circuit model, Latch-up in CMOS circuits.

UNIT –II:
Layout Design and Tools:
Transistor structures, Wires and Vias, Scalable Design rules, Layout Design tools.

Logic Gates & Layouts:
Static Complementary Gates, Switch Logic, Alternative Gate circuits, Low power gates, Resistive and Inductive interconnect delays.

UNIT –III:
Combinational Logic Networks:
Layouts, Simulation, Network delay, Interconnect design, Power optimization, Switch logic networks, Gate and Network testing.

UNIT –IV:
Sequential Systems:
Memory cells and Arrays, Clocking disciplines, Design, Power optimization, Design validation and testing

UNIT –V:
Floor Planning:
Floor planning methods, Global Interconnect, Floor Plan Design, Off-chip connections.

Suggested Books:
1. Essentials of VLSI Circuits and Systems, K. EshraghianEshraghian. D, A. Pucknell, 2005, PHI
2. Modern VLSI Design – Wayne Wolf, 3rd Ed., 1997, Pearson Education.
3. Introduction to VLSI Systems: A Logic, Circuit and System Perspective – Ming-BO Lin, CRC press
4. Principals of CMOS VLSI Design – N.H.E Weste, K. Eshraghian, 2nd Ed., Addison Wesley

Web Technologies
Code: CSEUGPE05
Contacts: 3L
Credits: 3

Course Outcomes:

CO 1: To learn the basics of HTML and can apply CSS on web pages.
CO 2: Create static and dynamic web pages and make a website also.
CO 3: Prepare XML documents and schemas to store and transport data.

CO 4: Write programs in PHP.
CO 5: Write a server side java application called Servlet to catch form data sent from client, process it and store it on database.

CO – PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12
CO1	3		3		2						2	
CO2		3			3							2
CO3	2		3		2	2					1	
CO4					3		3		2		1	
CO5			3	2	2					2		

Static Web Pages [3 Hrs]

HTML:Introduction, Editors, Elements, Attributes, Heading, Paragraph. Formatting, Link, Head, Table, List, Block, Layout,

Dynamic Web Pages [3Hrs]

The need of dynamic web pages; an overview of DHTML, Cascading Style Sheet (CSS), comparative studies of different technologies of dynamic page creation

Active Web Pages [3Hrs]

Need of active web pages;JavaApplets:Container Class, Components, Applet Life Cycle, Update method; Parameter passing Applet, Applications.

Java Script [4Hrs]

Data types, variables, operators, conditional statements, Array object, Date object, String object, Function, Errors, Validation.

Extensible Markup Language (XML) [3 Hrs]

Introduction, Tree, Syntax, Elements, Attributes, Validation, Viewing. XHTML in brief.

Cookies & Sessions [3 Hrs]

Definition of cookies; Create and Store a cookie with example; Sessions.

Java Servlet [3Hrs]

Servlet environment and role, HTML support, Servlet API, The Servlet life cycle, Servlet Programs.

JSP [10Hrs]

JSP architecture, JSP servers, JSP tags, understanding the layout in JSP, Declaring variables, methods in JSP, inserting java expression in JSP, processing request from user and generating

dynamic response for the user, inserting applets and java beans into JSP, using include and forward action, comparing JSP and CGI program, comparing JSP and ASP program; Creating ODBC data source name, introduction to JDBC, prepared statement and callable statement.

PHP & MySQL [4Hrs]

Overview ofPHP, Basics web programming usingPHP, Introducing MySQL, Database connectivity using PHP.

Suggested Books:

1. Uttam K. Roy: "Web Technologies", Oxford University Press.
2. Ivan Bayross, Sharanam Shah, Cynthia Bayross, Vaishali Shah: "Java Server Programming for Professionals", Shroff Publishers and Distributors.
3. C. Xavier: "Web Technology and Design", New Age.
4. Kogent Learning Solutions Inc.: "Web Technologies: HTML, JAVASCRIPT, PHP, JAVA, JSP, ASP.NET, XML and Ajax, Black Book: HTML, Javascript, PHP, Java, Jsp, XML and Ajax, Black Book", Dreamtech Press.
5. N.P. Gopalan and J. Akilandeswari:"Web Technology: A Developer's Perspective", PHI.
6. Luke Welling, Laura Thomson:"PHP and MySQL Web Development", Pearson Education.
7. Mike McGrath: "PHP and MySQL", McGraw Hill Education.
8. Meloni J C: "Sams Teach Yourself PHP MY SQL and Apache", Pearson Education.
9. Jain & Siddiqui with NIIT: "J2EE Professional Projects", PHI.
10. UttamK. Roy: "Advanced Java Programming", Oxford University Press.

Seminar and Presentation Skills

Code: CSEUGPR01
Contacts: 3P
Credits: 0

Course Outcomes:

CO 1: Enhance English language proficiency and verbal communication skills for professional and social interactions.
CO 2: Develop the ability to prepare, organize, and deliver effective seminar presentations on technical topics.
CO 3: Demonstrate skills in selecting appropriate technical topics for seminars, emphasizing research, structure, and content relevance.
CO 4: Apply best practices in technical presentations, including managing time, using visual aids, and handling Q&A sessions effectively.
CO 5: Improve confidence in public speaking, active listening, and communication, fostering skills for both professional and personal growth.

CO – PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12
CO1					2				2	3		3

CO2	**2**	**2**	**3**						**3**	**3**	**2**	**2**
CO3		**3**		**2**					**3**	**3**	**2**	
CO4			**2**	**3**					**3**	**3**	**3**	**3**
CO5						**3**	**3**	**3**	**3**	**3**	**2**	**3**

English language and verbal skills; Skills related to seminar and presentation; Selection of (preferably) technical topic; Practice sessions on seminar presentation; Do's and don'ts in seminar and technical presentation; Listening pre-recorded matters produced by British Council, Universities of Oxford, and University of Cambridge, etc. Preparing final presentation and facing question answer session at the end of presentation; boosting confidence in communication in social as well as professional lives.

Reference Books:

1. SM Gupta:"Current English Grammar and Usage",
2. Sashi Kumar: "Spoken English (with Cassette)" , TMH.
3. IshitaBhown:"Improve Your Presentation Skills (with CD)", V&S Publishers.
4. R. Sharma and Krishna Mohan:"Business Correspondence & Report Writing", McGraw Hill.

Compiler Design Lab

Code: CSEUGPC22
Contacts: 3P
Credits: 1.5

Course Outcomes:

CO 1: Explain the phases of compilation and identify the functions of lexical and syntax analyzers.
CO 2: Design and implement lexical analyzers using C programming and lexical analysis tools (like LEX).
CO 3: Analyze and modify grammars, including left recursion elimination and computation of FIRST and FOLLOW sets.
CO 4: Develop predictive and LALR parsers and understand syntax-directed translation methods.
CO 5: Generate syntax trees and intermediate code representations for various programming constructs.
CO 6: Apply code optimization techniques to enhance efficiency and execution performance.

CO – PO Mapping:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO 11**	**PO 12**
CO1	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
CO2	**3**	**3**	**2**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
CO3	**3**	**3**	**3**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
CO4	**3**	**3**	**3**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
CO5	**3**	**3**	**2**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

Syllabus

1. Design of a tiny lexical analyzer for lexical analysis using C programs.
2. Implement the lexical analyzer using lexical analyzer generating tools (LEX).
3. Program to check whether a grammar is left recursive or not, if it is remove left recursion.
4. Program for computation of FIRST AND FOLLOW of non-terminals.
5. Design of a predictive parser/LALR bottom up parser for a given language.
6. Conversion of BNF rules into YACC form
7. Write code for generating abstract syntax tree.

Reference Books:

1. A. V. Aho and J. D. Ullman: Principles of Compiler Design; Narosa Pub.
2. Holub: Compiler Design in C, PHI.
3. J. P. Tremblay and P. G. Sorenson: The Theory and Practice of Compiler Writing; McGraw Hill.
4. S. S. Muchnick: Advanced Compiler Design & Implementation; Narosa.
5. J. R. Levine, T. Mason and D. Brown: Lex and Yacc; O'Reilly.

Computer Networks lab

Code: CSEUGPC23
Contacts: 3P
Credits: 1.5

Course Outcomes:

CO1 Understand and Implement Network Hardware Components
CO2 Develop Basic Socket Programming Skills
CO3 Apply Data Link Layer Flow Control Techniques
CO4 Implement Error Detection and Control Mechanisms in the Data Link Layer

CO-PO mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12
CO1	3	2	-	-	2							
CO2	3	-	3	2	3					2		
CO3	3	3	3	2	3							
CO4	3	3	3	2	3							

1. **Familiarization with**
   - Networking cables (CAT5, UTP)
   - Connectors (RJ45, T-connector)
   - NIC Installation & Configuration (Windows/Linux)
   - Hubs, Switches
2. **TCP/UDP Socket Programming**
3. **Implementation/Simulation of**
   - Data Link Layer Flow Control Mechanism (Stop & Wait, Sliding Window)
   - Data Link Layer Error Detection Mechanism (Cyclic Redundancy Check)

- Data Link Layer Error Control Mechanism (Selective Repeat, Go Back N)

Reference Books:

1. Comer – "Internetworking with TCP/IP, vol. 1, 2, 3(4 th Ed.)" – Pearson Education/PHI
2. Unix Network Programming: The Sockets Networking Api, W. Richard Stevens, Bill Fenner, Andrew M. Rudoff
3. Hands-On Network Programming with C: Learn socket programming in C and write secure and optimized network code, Lewis Van Winkle

ELECTIVE – I Lab

Bioinformatics Lab

Code: CSEUGPE06
Contacts: 3P
Credits: 1.5

Course Outcomes:

CO 1: Utilize Python and R programming languages for bioinformatics data analysis and machine learning applications.
CO 2: Perform biological data pre-processing and data management using R packages to enhance the quality of raw datasets.
CO 3: Apply classification and clustering techniques to analyze microarray gene expression data for pattern recognition.
CO 4: Conduct sequence alignment tasks using tools like BLAST and FASTA for comparing DNA, RNA, and protein sequences.
CO 5: Analyze complex biological networks to understand interactions among genes, proteins, and other biological entities.
CO 6: Design research problems related to gene expression analysis and sequencing data for bioinformatics projects.

CO – PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12
CO1	**3**	**2**			**3**				**2**	**2**		**23**
CO2	**3**	**3**		**2**	**2**						**2**	
CO3	**3**	**3**	**3**	**2**						2		
CO4	**3**	**2**	**3**						**2**	3		
CO5	**3**	**3**	**3**	**3**		**2**	**2**					2
CO6	**3**	**3**	**3**	**2**	**2**			**2**	**3**	3	**3**	3

1. Explore machine learning tool "R" and python language.
2. Perform biological data pre-processing tasks using R package.
3. Demonstrate performing classification and clustering on microarray expression data sets.
4. Demonstrate performing sequence alignment task using BLAST and FASTA.
5. Demonstrate the complex biological network analysis.
6. Design several research problem related to the gene expression and sequencing data.

Reference Books:

[1] M. Lesk, "Introduction to Bio Informatics," Oxford University Press
[2] HoomanRashidi, Lukas K. Buehler, "Bioinformatics Basics: Applications in Biological Science andMedicine," CRC Press/Taylor & Francis Group, 2nd edition, May 2005
[3] Stephen A. Krawetz, David D. Womble, "Introduction to Bioinformatics: A Theoretical and PracticalApproach," Humana Press
[5] Bryan Bergeron, "Bioinformatics Computing," Prentice Hall PTR .

Data Science Lab

Code: CSEUGPE07
Contacts: 3P
Credits: 1.5

Course Outcomes:

CO 1: Perform elementary data operations, statistical measures, and hypothesis testing using tools like Python, MATLAB, or Excel.
CO 2: Conduct correlation analysis, regression analysis, classification, and clustering on various datasets for data-driven insights.
CO 3: Implement and interpret statistical distributions such as Chi-square, Normal, Poisson, T-distribution, Binomial, and Uniform distributions using programming.
CO 4: Apply machine learning algorithms like k-Nearest Neighbors, Multinomial Logistic Regression, and Support Vector Machines to solve classification problems.
CO 5: Perform big data processing using platforms like Hadoop or Spark for handling large-scale datasets.
CO 6: Develop skills in data visualization, hypothesis testing, and data interpretation to effectively communicate analytical results.

CO – PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12
CO1	3	3		2	3				2	2		3
CO2	3	3	3	2	2					2		2
CO3	3	2			2							3
CO4	3	3	2	2	3				2	3		
CO5	3	2		3	3	2					2	3
CO6	3	3	2		2			2	3	3	2	3

- Practice and assignments on elementary operations on data, statistical measures, distributions, hypothesis testing, correlation analysis, etc.
- Practice and assignments on relation analysis, regression, data classification and clustering techniques, association rules analysis, etc.
- Exercise and assignments on big data processing exercises in Hadoop, Sparc or related platform(s). eg.

  - Write a program to plot Chi square distribution

- Write a program to plot Normal distribution
- Write a program to plot Poisson distribution
- Write a program to plot T distribution
- Write a program to plot Binomial Distribution
- Write a program to plot Central limit theorem
- Write a program to plot Uniform distribution
- For the given data , perform Hypothesis Testing (two weeks)
- For the given data perform ANOVA and tell the difference of variance between groups
- For the data given , find the line of Linear regression and plot it
- For the data given , find the regression coefficients for multiple regression
- Calculate K-nearest neighbors for the data and classify
- Using in-built function calculate Multinomial logistic regression
- Using built-in function perform Support Vector machine algorithm

Suggested Softwares: Matlab ,Python,Excel.

Reference Books:

1. Hastie, Trevor, et al. The elements of statistical learning. Vol. 2. No. 1. New York: springer, 2009.
2. Montgomery, Douglas C., and George C. Runger. Applied statistics and probability for engineers. John Wiley & Sons, 2010
3. Bekkerman et al. Scaling up Machine Learning
4. AnandRajaraman and Jeffrey David Ullman, "Mining of Massive Datasets", Cambridge University Press, 2012.
5. Vincent Granville, Developing Analytic Talent: Becoming a Data Scientist, wiley, 2014.

Image Processing Lab

Code: CSEUGPE08
Contacts: 3P
Credits: 1.5

Course Outcomes:

CO 1: Understand fundamental concepts of digital images, image perception, spatial resolution, and image data types.
CO 2: Perform point processing, arithmetic operations, and intensity transformations on images to enhance visual quality.
CO 3: Apply spatial and frequency domain filtering techniques for image smoothing and sharpening using Python and MATLAB.
CO 4: Implement image segmentation, morphological operations, and feature extraction techniques for object recognition.
CO 5: Utilize image compression techniques to optimize storage and transmission efficiency.

CO – PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12

CO1	**3**	**2**			**3**					**2**		**2**
CO2	**3**	**3**		**2**	**3**					**2**		**2**
CO3	**3**	**2**	**3**	**3**	**3**					**2**		**3**
CO4	**3**	**3**	**3**	**2**	**3**				**2**	**3**		**2**
CO5	**3**	**2**		**3**	**3**					**2**	**2**	**3**

Images and digital images, File Sizes, Image perception, Greyscale images, RGB Images, Data types and conversions, Spatial Resolution.

Point Processing, Arithmetic operations, Addition/subtraction/multiplication of images, Linear and non-linear transformations in intensity space, histograms processing,

Spatial Domain filtering, Smoothing & their variants, Sharpening & their variants; Frequency domain filtering, Smoothing & their variants, Sharpening & their variants

Thresholding, component labelling, point/line/edge segmentation, morphological operations, feature extraction; Image compression with multiple techniques.

Suggested Books and References:

1. R. Gonzalez, R. Woods and S. Eddins, "Digital Image Processing Using MATLAB", McGraw Hill
2. A. Pajankar "Python 3 Image Processing", BPB publication.
3. S. Dey, "Hands-On Image Processing with Python", Packt publication.

VLSI Design Lab

Code: CSEUGPE09
Contacts: 3P
Credits: 105
Course Outcomes:

CO 1: Have knowledge about sequential & combinational digital system designs.
CO 2: Write HDL code for basic as well as advanced digital integrated circuits.
CO 3: Import the logic modules into FPGA Boards.
CO 4: Design a microcontroller based systems.

CO – PO Mapping:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO 11**	**PO 12**
CO1	3	2										
CO2	3		2									
CO3	1				2							
CO4					2		3				1	2

i. Familiarization with analog and digital CAD tools.
ii. Implementation of MOS inverter circuits using CAD tools and verification of different characteristics of an inverter.
iii. Implementation MOS current mirrors and current sources.
iv. Implementation of NAND and NOR gates using CMOS logic and observation of their static and dynamic behaviors.
v. Design of flip-flop circuits and study of its transient behavior.

vi. Mask layout of an inverter, application of design verification rules, RC extraction, pre and post layout comparison of characteristics

Reference Books :

1. Baker, R.J., Lee, H. W. and Boyce, D. E., CMOS Circuit Design, Layout and Simulation, Wiley - IEEE Press (2004) 2nd ed.
2. Weste, N.H.E., Harris, D. and Banerjee, A., CMOS VLSI Design, Dorling Kindersley (2006) 3rd ed.
3. Rabaey, J.M., Chandrakasen, A.P. and Nikolic, B., Digital Integrated Circuits – A Design perspective, Pearson Education (2007) 2nd ed.

Web Technologies Lab

Code: CSEUGPE10
Contacts: 3P
Credits: 1.5

Course Outcomes:

CO 1: Design and develop responsive web pages using HTML, CSS, and JavaScript.
CO 2: Apply client-side programming techniques using JavaScript for interactive web applications.
CO 3: Implement server-side programming using Servlets, JSP, and Java Database Connectivity (JDBC) for dynamic web applications.
CO 4: Utilize PHP and MySQL for back-end web development and database management.
CO 5: Demonstrate skills in integrating cookies, XML, and other technologies for enhanced web functionality.

CO – PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12
CO1	**3**	**2**	**3**		**3**				**2**	**2**		**2**
CO2	**3**	**3**	**2**	**2**	**3**				**2**	**2**		**2**
CO3	**3**	**3**	**3**	**3**	**3**				**2**	3	**2**	**3**
CO4	**3**	**2**	**3**	**3**	**3**				**2**	2	**3**	**3**
CO5	**3**	**2**	**2**	**2**	**3**				**2**	2	**2**	**3**

1. Web Page Design using HTML
2. Use of CSS in Designing Web Pages
3. Applet Design
4. Application of JavaScript in Web Page Development
5. Usage of Cookies & XML
6. Server Side Programming through Servlets
7. Application of Java Server Pages in Server Side programming
8. Application of Java Database Connectivity
9. Web design using PHP and MySQL

Suggested Books:

1. Uttam K. Roy: “Web Technologies”, Oxford University Press.
2. Ivan Bayross, Sharanam Shah, Cynthia Bayross, Vaishali Shah: “Java Server Programming for Professionals”, Shroff Publishers and Distributors.

3. C. Xavier: "Web Technology and Design", New Age.
4. Kogent Learning Solutions Inc.: "Web Technologies: HTML, JAVASCRIPT, PHP, JAVA, JSP, ASP.NET, XML and Ajax, Black Book: HTML, Javascript, PHP, Java, Jsp, XML and Ajax, Black Book", Dreamtech Press.

Semester VII:

Machine Learning & Soft Computing

Code: CSEUGPC24
Contacts: 3L
Credits: 3

Course Outcomes:

CO 1: Understand and apply fuzzy logic principles, fuzzy sets, and approximate reasoning for solving real-world problems in areas like vision, pattern recognition, and robotics.
CO 2: Implement fuzzy inference systems using fuzzy relations and operators for decision-making processes.
CO 3: Apply genetic algorithms (GAs) for optimization problems using encoding, selection, crossover, mutation, and convergence analysis.
CO 4: Develop and implement machine learning algorithms for classification and prediction using techniques like k-NN, decision trees, Bayesian classification, and neural networks.
CO 5: Analyze and evaluate the performance of various soft computing techniques in real-world applications.

CO – PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12
CO1	3	2	3	2					2	2		2
CO2	3	2	2		2				2	2		2
CO3	3	3	3	3	3				2	2	1	2
CO4	3	3	3	3	3				2	1		2
CO5	3	3	3	3	2				2	2	2	3

Module-1 [12 Hrs]:

Fuzzy Logic and Approximate Reasoning: Conventional and fuzzy sets, Basic concepts of fuzzy logic, Fuzzy expressions: Basic principles of fuzzy logic and fuzzy inference rules, fuzzy relations, fuzzy operators, realization of fuzzy systems using fuzzy relations , application of fuzzy logic in vision, pattern recognition, robotics and linguistics.

Approximate reasoning in Experts Systems, Fuzzy sets in approximate reasoning, Fuzzy propositions in approximate reasoning. Transition Modifier rules, Basic principles of approximate reasoning and rules of inference.

Module-2 [12 Hrs]

Genetic Algorithms (GAs) : Introduction to GAs, Binary encodings of candidate solutions, Schema Theorem and Building Block Hypothesis, Genetic operators – crossover and

mutation, parameters for GAs, Reproduction mechanism for producing Offspring, Darwinian Principle in evaluating objective function. Convergence Analysis: Simple GA schemes, Stochastic models: GA approaches to optimization problems

Module-3 [12 Hrs]
Machine learning foundations – probabilistic framework, algorithms.
Classification and Predictions:What is Classification & Prediction, Issues regarding Classification and prediction, k-NN, Decision tree, Bayesian Classification, Classification by Back propagation, Multilayer feed-forward Neural Network, Back propagation Algorithm.

Suggested Books:

1. J. S. R. Jang C. T. Sun and E. Mizutani: "Neuro- Fuzzy and Soft Computing : A Computational Approach to Learning and Machine Intelligence", Pearson.
2. T. J. Ross:"Fuzzy Logic with Engineering Applications", Wiley.
3. B. Kosko:"Neural Network and Fuzzy Systems : A Dynamical Systems Approach to Machine Intelligence", PHI, 1992.
4. G. J. Klir, B. Yuan: "Fuzzy sets and Fuzzy logic: Theory and Applications", PHI, 1995.
5. David E. Goldberg: "Genetic Algorithms in Search, Optimization and Machine Learning", Addision Wesley, MA, 1989.
6. S. Haykin: "Neural Networks - A Comprehensive Foundation", Macmillan College Publishing Company, New York, 1994.

Industrial Economics & Management

Code: MBAUGHU01
Contacts: 4L
Credits: 4

Course outcomes:

CO 1: Understand and apply fundamental economic principles including micro and macroeconomics, demand analysis, and money banking in the context of engineering and technology.
CO 2: Demonstrate knowledge of organizational behavior, including management theories, motivation, communication, and perception.
CO 3: Comprehend and apply human resource management practices, including recruitment, training, performance appraisal, and industrial relations.
CO 4: Understand the principles of quality management, including Total Quality Management (TQM), Six Sigma, and Statistical Quality Control (SQC).
CO 5: Analyze and manage production processes, types of production, and productivity enhancement techniques.
CO 6: Apply fundamental concepts of financial management, marketing management, and materials management for effective decision-making in business operations.

CO - PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12
CO1	3	2		2						1		
CO2		2								3		

CO3		**2**	**3**			**2**			**3**	2		
CO4			**3**		**3**				**2**	2	**2**	**3**
CO5	**3**	**2**	**2**		**3**						**2**	**3**
CO6				**3**			**2**			3	**2**	

Module no	Content of the module	Allotted hours
1	**Economics:** Introduction and Basic Economics Terms: Nature and Significance of Economics, Role of Economics in Engineering and Technology, Basic Economic: Utility, Saving, Investment, Equilibrium, Micro and Macro Economics, Liberalization, Privatization, Globalisation. Demand Analysis, Elasticity of Demand, Demand Forecasting, Factors of Production. Money Banking and Trade: Functions of money, supply & demand for money, money price level & inflation, black money, meaning, magnitude & consequences. Banking system in India, Functions of Commercial banks, Function of RBI, Sources of public revenue, principles of taxation, direct and indirect taxes, balance of trade and payment.	10
2	**Organizational Behavior:** Basic concepts of management, objectives, classification and hierarchy, Different Schools of Management Thought, Motivation: Concept, Different Theories (Maslow, ERG, Herzberg) Communication: Purpose, process, Barriers to effective communication, Guidelines to make communication effective. Perception: Process, Importance, Factors influencing perception, Shortcuts for judging people- Halo effect, Stereotyping, Projection.	5
3	**Human Resource Management:** Recruitment and selection, Training, Performance appraisal, Industrial Relations, Trade Union, Collective Bargaining	5
4	**Quality Management**: Concept, Dimensions for goods and services, Cost of Quality, Statistical Quality Control, Control Charts, Acceptance Sampling (single). Quality circle. Total Quality Management: Concept, benefits, Criticism. New Quality Tools: Kaizen, Six Sigma, Quality Circles.	5
5	**Productions Management:** Concept, Difference from Operations Management, Types of Production (Mass, Batch, Project), Functions of Production Management. Productivity: Concept, Different Inputs and Productivity Measures, Efficiency and Effectiveness, Measures to increase Productivity.	6
6	**Marketing Management:** Basic Concepts of Marketing, Difference between Selling and Marketing, Elements of Marketing Mix- the 4 P's., STP. Marketing Research: Definition, Process, Importance, SWOT Analysis, BCG Matrix, GE Matrix.	6
7	**Financial Management:** Use of management science for the efficient administration of economic	6

	units, cost benefit analysis, present work and breakeven analysis, budgetary control.	
8	**Materials Management:** Concept, Functions, EOQ Models, Selective Inventory Control—ABC, VED, FSN analysis	5

Suggested Books:

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1. L. C. Jhamb:"A Text Book of Industrial Engineering (Vol.1)",Publisher: Everest Publishing House.
2. Anil Bhat & Arya Kumar: "Management: Principles, Processes and Practices", Publisher: OUP.
3. Martand T. Telsang: "Industrial & Business Management", Publisher: S. Chand.
4. RajanMisra: " (2009) Engineering Economics", University Science Press, An imprint of LaxmiPubliactionsPvt. Ltd., New Delhi.

ELECTIVE – II

Natural Language Processing

Code:CSEUGPE11
Contacts: 3L
Credits: 3

Course Outcome:

CO 1: Understanding fundamentals of NLP with syntax and semantics rules and its applications
CO 2: Mastering Text Processing Operations and word embedding techniques
CO 3: Learning statistical Language modelling techniques
CO 4: Understanding Document clustering and Information Retrieval Techniques
CO 5: Ability to perform Text Classification, language translation, and natural language generation using Machine Learning and Deep Learning

CO – PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12
CO1	3	2										
CO2			3		1							
CO3		3	2	3	1							
CO4	3			2	1							
CO5	2			3	2	1						

Unit I. Regular Expressions and Automata [2 Hrs]
Introduction to NLP, Regular Expression, Finite State Automata

Unit II. Basic Text Processing [6 Hrs]
Word Tokenization, Normalization, Sentence Segmentation, Named Entity Recognition,Multi Word Extraction, Spell Checking – Bayesian Approach, Minimum Edit Distance; Morphology – Inflectional and Derivational Morphology, Finite State MorphologicalParsing, The Lexicon and Morphotactics, Morphological Parsing with Finite StateTransducers, Orthographic Rules and Finite State Transducers, Porter Stemmer

Unit III. Language Modeling [8 Hrs]
Introduction to N-grams, Chain Rule, Smoothing – Add-One Smoothing, Witten-BellDiscounting; Backoff, Deleted Interpolation, N-grams for Spelling and Word Prediction, Evaluation of language models; Markov Chain, Hidden Markov Models, Forward Algorithm, Viterbi Algorithm, Part ofSpeech Tagging – Rule based and Machine Learning based approaches, Evaluation

Unit IV. Text Classification [6 Hrs]
Text Classification, Naïve Bayes' Text Classification, Evaluation, Sentiment Analysis – Opinion Mining and Emotion Analysis, Resources and Techniques

Unit V. CFG and Lexical Semantics [6 Hrs]
Context Free Grammar and Constituency, Some common CFG phenomena for English,Top-Down and Bottom-up parsing, Probabilistic Context Free Grammar, DependencyParsing; Introduction to Lexical Semantics – Homonymy, Polysemy, Synonymy, Thesaurus – WordNet, Computational Lexical Semantics – Thesaurus based and Distributional WordSimilarity

Unit VI. Information Retrieval [8 Hrs]
Boolean Retrieval, Term-document incidence, The Inverted Index, Query Optimization,Phrase Queries, Ranked Retrieval – Term Frequency – Inverse Document Frequencybased ranking, Zone Indexing, Query term proximity, Cosine ranking, Combiningdifferent features for ranking, Search Engine Evaluation, Relevance Feedback

Suggested Books:

1. Jurafsky and Martin: "Speech and Language Processing", Pearson Education.
2. Manning and Schutze: "Foundation of Statistical Natural Language Processing", MIT.

Internet of Things

Code: CSEUGPE12
Contacts: 3L
Credits: 3

Course Outcomes:

CO 1: Understand the fundamental concepts of IoT, including sensing, actuation, and networking basics.
CO 2: Develop hands-on skills with Arduino, Raspberry Pi, and sensor-actuator integration for IoT applications.
CO 3: Apply knowledge of IoT interoperability, cloud computing, and Python programming to real-world scenarios.

CO 4: Analyze advanced IoT concepts such as fog computing and their applications in smart cities, smart homes, and connected vehicles.

CO 5: Demonstrate the ability to work on case studies related to IoT implementations in agriculture, healthcare, and activity monitoring.

CO – PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12
CO1	3											
CO2	2	3	3	2					2			
CO3	2	2	2		3							2
CO4	2	3	2		3		2					
CO5		2	3	3						2	3	

Module 1: [12 Hrs]
Introduction to IoT: Sensing, Actuation, Basics of Networking.
Basics of Networking, Communication Protocols, Sensor Networks.
Machine-to-Machine Communications

Module 2: [12 Hrs]
Interoperability in IoT, Introduction to Arduino Programming, Integration of Sensors and Actuators with Arduino.
Introduction to Python programming, Introduction to Raspberry Pi, Implementation of IoT with Raspberry Pi.
Cloud Computing.

Module 3: [12 Hrs]
Fog Computing, Smart Cities and Smart Homes.
Connected Vehicles, Smart Grid, Industrial IoT.
Case Study: Agriculture, Healthcare, Activity Monitoring.

Suggested Books:

1. Pethuru Raj and Anupama C. Raman:"The Internet of Things: Enabling Technologies, Platforms, and Use Cases", CRC Press.
2. ArshdeepBahga and Vijay Madisetti:"Internet of Things: A Hands-on Approach", Universities Press.

Advanced Java Programming

Code: CSEUGPE13
Contacts: 3L
Credits: 3

Course Outcomes:

CO 1: Recap fundamental Java concepts and develop proficiency in object-oriented programming techniques.

CO 2: Understand networking concepts and implement socket programming for client-server applications.

CO 3: Gain expertise in database connectivity using JDBC and execute SQL statements through Java applications.
CO 4: Develop event-driven programs using AWT components and event handling mechanisms.
CO 5: Implement dynamic web applications using Java Servlets.
CO 6: Design graphical user interfaces with Java Swing for enhanced user interaction.

CO – PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12
CO1	3											
CO2	3	2	2						2			
CO3	3	3	3		2							2
CO4	2	3	2		2					2		
CO5	2	2	3		3		2				3	
CO6	3	2	3		2							

UNIT I: Introduction [6 Hrs]

Recapitulation of Basic Concepts in Java: Objects, Classes, Encapsulation, Inheritance, Polymorphism, Packages, Access Protection, Interfaces, Arrays, Applets, Exception Handling, Multithreading, String Handling.

UNIT II: Networking [6 Hrs]

Internet Addressing, InetAddress, Factory Methods, Instance Methods, TCP/IP Client Sockets, URL, URL Connection, TCP/IP Server Sockets, Datagrams.

UNIT III: Java Database Connectivity (JDBC) [6 Hrs]

Introduction, Database driver,Different approaches to connect an application to a database server, Establishing a database connection and executing SQL statements, JDBC Prepared statements, JDBC data sources.

UNIT IV: Event Handling [6 Hrs]

Events, Event sources, Event classes, Event Listeners, Delegation event model, handling mouse and keyboard events, Adapter classes. The AWT class hierarchy, user interface components- labels, button, canvas, scrollbars, text components, check box, check box groups, choices, lists panels – scroll pane, dialogs, menu bar, graphics, layout manager – layout manager types – border, grid, flow, card and grid bag.

UNIT V: Java Servlet [5 Hours]
Servlet as an improved CGI, Servlet Fundamentals / API, What is a Web-Container, Servlet Life Cycle / Architecture, HTTP GET and POST Request Method, Processing Html Forms, What is Name-Value pair, Content Types and MIME.

UNIT VI: Java Swing [7 Hrs]
Introduction, limitations of AWT, MVC architecture, components, containers, exploring swing- JApplet, JFrame and JComponent, Icons and Labels, text fields, buttons – The JButton class, Check boxes, Radio buttons, Combo boxes, Tabbed Panes, Scroll Panes, Trees and Tables.

Suggested Books:

1. E Balagurusamy: ―Programming with Java‖, McGraw Hill Education.
2. Herbert Schildt:―Java: The Complete Reference,McGraw Hill Education.
3. Sachin Malhotra and Saurabh Choudhary:―Programming in Java, Oxford University Press.
4. Y. Daniel Liang:―Introduction to Java Programming, Brief Version, Pearson Education.
5. Y. Daniel Liang:―Introduction to Java Programming, Comprehensive Version‖, Pearson Education.
6. Cay S. Horstmann: ―Core Java - Vol. I, Vol. II and Vol. II, Pearson Education.
7. Paul J. Deitel and H. Deitel: ―Java 9 for Programmers, Pearson Education India.
8. Harold Elliotte Rusty: ―Java Network Programming, Shroff Publishers & Distributers.
9. George Reese: ―Java Database Best Practices: Persistence Models and Techniques for Java Database Programming, O'Reilly.
10. Uttam K. Roy: ―Advanced Java Programming, Oxford University Press.

Computational Geometry

Code: CSEUGPE14
Contacts: 3L
Credits: 3

Course Outcomes:

- **CO 1:** Explain fundamental concepts and algorithms in computational geometry, such as convex hulls and triangulations.
- **CO 2:** Implement and analyze Voronoi diagrams and Delaunay triangulations in solving geometric problems.
- **CO 3:** Apply geometric searching and visibility techniques to problems like point location and art-gallery problems.
- **CO 4:** Utilize arrangement techniques and sweep-line algorithms to solve complex geometric problems.
- **CO 5:** Apply combinatorial and rectilinear geometry techniques for problem-solving in real-world applications.

CO – PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12
CO1	3	3	2	1	2	1				1		
CO2	3	3	2	2	2	1						
CO3	3	3	2	3	3	2				1		
CO4		3	3	2	3	3	1				1	
CO5	3	3	3	3	3	2	1			2	1	

Unit I [6 Hrs]
Introduction, historical perspective, geometric preliminaries. Convex hulls algorithms in 2d and 3d, lower bounds. Triangulations: polygon triangulations, representations, point-set triangulations.

Unit II [8 Hrs]
Voronoi diagrams: algorithms, closest pair problems. Delaunay triangulations: algorithms (divide-and-conquer, flip, incremental), duality of Voronoi diagrams, properties (min-max angle).

Unit III [6 Hrs]
Geometric searching: point-location, 2d linear programming with prune and search. Visibility: algorithms for weak and strong visibility, visibility with reflections, art-gallery problems.

Unit IV [8 Hrs]
Arrangements of lines: 2d arrangements, zone theorem, many-faces complexity, algorithms. Sweep techniques: plane sweep for segment intersections, Fortune's sweep for Voronoi diagrams, topological sweep for line arrangements.

Unit V[8L]
Combinatorial geometry: Ham-sandwich cuts, Helly's theorems, k-sets. Rectilinear geometry: intersection and union of rectangles, rectangle searching. Robust geometric computing.Applications of computational geometry.

Reference Books

1. Berg, Cheong,Kreveld and Overmars:"Computational Geometry – Algorithms and Applications" 3e, Springer.
2. Preparata and Shamos:"Computational Geometry – An Introduction", Springer.
3. Joseph O'Rourke: "Computational Geometry in C, 2e", Cambridge University Press.
4. David Mount: "Lecture Notes".

ELECTIVE – III

Computer Vision
Code: CSEUGPE15
Contacts: 3L
Credits: 3

Course Outcomes:

CO 1: Students demonstrate a thorough understanding of fundamental concepts in computer vision (camera and projection models, image formation, image features, and calibration, stereo).

CO 2: Students must be able to design and conduct experimental validation for a computational approach to a computer vision problem, and interpret the results to assess the performance (accuracy, efficiency, robustness) of the method.

CO 3: Students are familiar with methods used in various vision-based applications – image feature detection, camera calibration, 3-D reconstruction, segmentation.

CO 4: Students are better prepared to analyze a problem and assess the strengths and weaknesses of different methods and techniques for solving it.

CO 5: Students should demonstrate the ability to present and discuss a body of research work in computer vision.

CO – PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12
CO1	1	2	3									
CO2	1	2	3									
CO3			1						3		2	
CO4		3	1	2								
CO5						1					3	2

Module - 1 [3 Hrs]

Image formation: Monocular imaging system, Orthographic & Perspective Projection, Camera model and Camera calibration, Binocular imaging systems.

Module - 2 [7 Hrs]

Processing & Analysis: Overview of Image Processing System, Image Digitization (Sampling and Quantization), Digital Image, Fundamentals of Color image, Color Models (RGB, YCbCr, HIS), Image File Format, Spatial & Frequency Domain Image analysis (Filtering, Correlation, Convolution), Morphological Image Processing&Morphological Algorithms.

Module - 3 [6 Hrs]

Segmentation: Point Detection, Line Detection, Edge Detection **,**Edge Linking and Edge Following by Local Processing, Hough Transform, Thresholding, Region segmentation, Active contours, Split and merge, Mean shift and mode finding, Normalized cuts, Graph cuts and energy-based methods.

Module - 4 [9 Hrs]

Representation & Feature Extraction: Boundary Representation by Chain Codes, Polygonal Approximation, Skeletons Component Labeling and Counting Geometrical, Texture Analysis, Geometric Moments Texture Descriptor, Gray-level Co Occurrence Matrix, some object recognition methods, Shape correspondence and shape matching, Principal Component analysis, Shape priors for recognition, Texture Description.

Module - 5 [5 Hrs]

Motion Structure & Estimation:

Triangulation, Two-frame structure from motion, Factorization, Bundle adjustment, Constrained structure and motion, Translational alignment, Parametric motion, Spline-based motion, Optical flow, Layered motion.

Module - 6 [6 Hrs]

Recognition:

Object detection, Face recognition, Instance recognition, Category recognition, Context and scene understanding, Recognition databases and test sets.

Suggested Books:

4. Richard Szeliski, "Computer Vision: Algorithms and Applications", Springer, 2010.
5. Shapiro, L. & Stockman, G., "Computer Vision". Prentice Hall, 2001.
6. D. Forsyth and J. Ponce, "Computer Vision - A modern approach", Prentice Hall.
7. E. Trucco and A. Verri, "Introductory Techniques for 3D Computer Vision", Publisher: Prentice Hall.
8. Haralick R M and Shapiro L G, "Computer & Robot Vision", Vo: I and II Addison Wesley, 1993.
9. Rafael C. Gonzalez and Richard E. Woods, "Digital Image Processing".
10. B. Chanda and D. Dutta Majumder, "Digital Image Processing and Analysis".
11. The Computer Vision Homepage" (Carnegie Mellon University): http://www-2.cs.cmu.edu/_cil/vision.html.

Mobile Computing

Code: CSEUGPE16
Contacts: 3L
Credits: 3

Course Outcomes:

CO 1: Understand the fundamentals of wireless networking, mobile computing, and wireless transmission technologies.
CO 2: Analyze and evaluate various Medium Access Control (MAC) protocols, including FDMA, TDMA, and CDMA, along with Wireless LAN and Bluetooth architectures.
CO 3: Explain the principles of mobile ad-hoc networks and implement routing protocols like AODV, DSR, and DSDV for efficient data communication.
CO 4: Demonstrate an understanding of mobile networking protocols (Mobile IP) and assess the impact of mobility on transport protocols.
CO 5: Develop strategies for power management, wireless application protocols, and security in mobile environments.
CO 6: Understand fault tolerance and design solutions to enhance TCP performance in wireless links.

CO – PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12
CO1	3											
CO2	3	2	2						2			
CO3	3	3	3		2							2
CO4	2	3	2		2					2		
CO5	2	2	3		3		2				3	
CO6	3	2	3		2							

Module-1: [12 Hrs]
Introduction to wireless networking and characteristics of mobile computing; Fundamentals of wireless transmission - Medium Access Control Protocols FDMA, TDMA, CDMA; Overview of Wireless LAN (IEEE 802.11); Overview of Bluetooth architecture

Module-2: [12 Hrs]
Introduction to Mobile Adhoc Network and routing protocols- DSDV, WRP, CGSR, FSR, AODV, DSR, ABR, TORA etc.; Mobile Networking protocol (Mobile IP); Mobile transport

layer - Effects of mobility on Reliable Transport Protocols; Mechanisms for improving TCP performances on wireless links

Module-3: [12 Hrs]
Energy / Power Management; Wireless application Environments Wireless Application Protocol, WML, Push Architecture, Push/Pull Services; Overview of Security in mobile environments; Overview of fault tolerance in mobile computing systems.

Suggested Books:

1. C. Siva Ram Murthy and B. S. Manoj: "Ad Hoc Wireless Networks: Architectures and Protocols", Pearson.
2. Charles Perkins: "Adhoc Networking", Pearson Education.
3. W. Stallings:"Wireless Communication", Pearson.

Visual Programming & Multimedia

Code: CSEUGPE17
Contacts: 3L
Credits: 3

Course Outcomes:

CO 1: Understand the fundamentals of Windows programming, including window creation, message handling, and device context management.
CO 2: Develop applications using Visual C++ with a focus on the MFC library, event handling, and dialog-based applications.
CO 3: Apply the Document/View architecture to create Single Document Interface (SDI) and Multiple Document Interface (MDI) applications, as well as ActiveX controls.
CO 4: Demonstrate advanced programming skills using ODBC, threading, and multimedia components in Visual C++.
CO 5: Analyze the principles of multimedia systems, including text, audio, image, and video processing.
CO 6: Design and implement multimedia databases, content management systems, and web publishing using standard multimedia coding techniques.

CO – PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12
CO1	3											
CO2	3	2	3		2				2			
CO3	3	3	3		2							2
CO4	3	3	2		3					2		
CO5	2	2	3		2							
CO6	3	2	3		2						2	

Module 1: [12 Hrs]

WINDOWS PROGRAMMING:

Windows environment – a simple windows program – windows and messages – creating the window – displaying the window – message loop – the window procedure –
message processing – text output – painting and repainting – introduction to GDI – device context – basic drawing – child window controls

VISUAL C++ PROGRAMMING – INTRODUCTION:

Application Framework – MFC library – Visual C++ Components – Event Handling – Mapping modes – colors – fonts – modal and modeless dialog – windows common controls – bitmaps

THE DOCUMENT AND VIEW ARCHITECTURE:

Menus – Keyboard accelerators – rich edit control – toolbars – status bars – reusable frame window base class – separating document from its view – reading and writing SDI and MDI documents – splitter window and multiple views – creating DLLs – dialog based applications

Module 2: [12 Hrs]

ACTIVEX AND OBJECT LINKING AND EMBEDDING (OLE):

ActiveX controls Vs. Ordinary Windows Controls – Installing ActiveX controls – Calendar Control – ActiveX control container programming – create ActiveX control at runtime – Component Object Model (COM) – containment and aggregation Vs. inheritance – OLE drag and drop – OLE embedded component and containers – sample applications

ADVANCED CONCEPTS:

Database Management with Microsoft ODBC – Structured Query Language – MFC ODBC classes – sample database applications – filter and sort strings – DAO concepts – displaying database records in scrolling view – Threading – VC++ Networking issues – Winsock – WinInet – building a web client – Internet Information Server – ISAPI server extension – chat application – playing and multimedia (sound and video) files

Module 3: [14 Hrs]

<u>Multimedia</u>

Introduction:

Multimedia today, Impact of Multimedia, Multimedia Systems, Components and Its Applications

Text and Audio:

Text: Types of Text, Ways to Present Text, Aspects of Text Design, Character, Character Set, Codes, Unicode, Encryption; Audio: Basic Sound Concepts, Types of Sound, Digitizing Sound, Computer Representation of Sound (Sampling Rate, Sampling Size, Quantization), Audio Formats, Audio tools, MIDI

Image and Video:

Image: Formats, Image Color Scheme, Image Enhancement; Video: Analogue and Digital Video, Recording Formats and Standards (JPEG, MPEG, H.261) Transmission of Video Signals, Video Capture, and Computer based Animation.

Synchronization:

Temporal relationships, synchronization accuracy specification factors, quality of service

Storage models and Access Techniques:

Magnetic media, optical media, file systems (traditional, multimedia) Multimedia devices – Output devices, CD-ROM, DVD, Scanner, and CCD

Image and Video Database:

Image representation, segmentation, similarity based retrieval, image retrieval by color, shape and texture; indexing- k-d trees, R-trees, quad trees; Case studies- QBIC, Virage. Video Content, querying, video segmentation, indexing

Document Architecture and Content Management:

Content Design and Development, General Design Principles Hypertext: Concept, Open Document Architecture (ODA), Multimedia and Hypermedia Coding Expert Group (MHEG), Standard Generalized Markup Language (SGML), Document Type Definition (DTD), Hypertext Markup Language (HTML) in Web Publishing. Case study of Applications

Suggested Books:

1. Charles Petzold: "Windows Programming", Microsoft Press, 1998.
2. David J. Kruglinski, George Shepherd, Scot Wingo: "Programming Microsoft
3. Visual C++", Microsoft Press, 2006.
4. Kate Gregory: 'Using Visual C++", Prentice Hall of India Pvt., Ltd., 1999.
5. Buford J. K.: "Multimedia Systems" – Pearson Education.
6. Andleigh&Thakrar: "Multimedia", PHI
7. Balagurusamy E: "Programming in C#", Tata McGraw Hill, 2010.

Information and Coding Theory

Code: CSEUGPE18
Contacts: 3L
Credits: 3

Course Outcomes:

CO 1: Understand the fundamental concepts of information theory, including entropy, mutual information, and channel capacity, to analyze communication systems.

CO 2: Apply source coding techniques, such as Shannon's algorithm and Huffman coding, for efficient data compression.

CO 3: Analyze communication channels using concepts like discrete memoryless channels and channel capacity theorems to determine performance limits.

CO 4: Design and implement error control coding techniques, including linear block codes, cyclic codes, BCH codes, and RS codes, to ensure reliable data transmission.

CO 5: Solve problems related to error detection and correction using decoding algorithms for various coding schemes.

CO 6: Explore advanced coding techniques, including burst error correction and convolutional coding, and evaluate their applications in modern communication systems.

CO – PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12
CO1	3	3	2	--	2	--	--	--	--	--	--	1
CO2	3	3	3	--	2	--	--	--	--	1	--	1
CO3	3	3	2	2	2	--	--	--	--	--	--	--
CO4	3	3	3	3	3	1	--	--	1	--	--	1
CO5	3	3	3	3	2	--	--	--	1	--	--	--
CO6	3	2	3	3	3	--	2	1	1	--	1	2

Module-1: [12 Hrs]

Information Theory: Introduction, Measure of information, Average information content of symbols in long independent sequences, Average information content of symbols in long dependent sequences. Mark-off statistical model for information source, Entropy and information rate of mark-off source.

Module- 2: [12 Hrs]

Source Coding: Encoding of the source output, Shannon's encoding algorithm. Communication Channels, Discrete communication channels, Continuous channels.

Fundamental Limits on Performance: Source coding theorem, Huffman coding, Discrete memory less Channels, Mutual information, Channel Capacity.

Channel coding theorem, Differential entropy and mutual information for continuous ensembles, Channel capacity Theorem.

Module-3: [12 Hrs]

Introduction to Error Control Coding: Introduction, Types of errors, examples, Types of codes Linear Block Codes: Matrix description, Error detection and correction, Standard arrays and table look up for decoding. Binary Cycle Codes, Algebraic structures of cyclic codes, Encoding using an (n-k) bit shift register, Syndrome calculation.BCH codes. RS codes, Golay codes, Shortened cyclic codes, Burst error correcting codes. Burst and Random Error correcting codes. Convolution Codes, Time domain approach. Transform domain approach.

Suggested Books:

1. K. Sam Shanmugam: "Digital and analog communication systems", John Wiley, 1996.
2. Simon Haykin: "Digital Communication", John Wiley, 2003.

3. Ranjan Bose: "ITC and Cryptography", TMH, II edition, 2007.
1. Glover and Grant: "Digital Communications", Pearson Ed. 2nd Ed 2008.

E- Commerce and ERP

Code: CSEUGPE19
Contacts: 3L
Credits: 3

Course Outcomes:

CO 1: Describe the importance of IT enabled services and challenges.
CO 2: Identify strategic IT planning for software development.
CO 3: Recognize enterprise IT architecture for Information technology.
CO 4: Use of information Technology so as to enable them for job in sunrise industries.
CO 5: Illustrate various IT web services for betterment of knowledge.
CO 6: Use their skills to find out various current IT trends in ITES.

CO – PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12
CO1	1			1		1						
CO2		2		2							1	
CO3		3	2	1				1		1		
CO4	1					1					1	
CO5	2	1	3		1			1				
CO6	1			1		1						

Module 1: [12 Hrs]
E – Commerce

Electronic Commerce : Overview, Definitions, Advantages & Disadvantages of E – Commerce, Threats of E – Commerce, Managerial Prospective, Rules & Regulations For Controlling E – Commerce, Cyber Laws.

Technologies : Relationship Between E – Commerce & Networking, Different Types of Networking For E – Commerce, Internet, Intranet & Extranet, EDI Systems
Wireless Application Protocol : Definition, Hand Held Devices, Mobility & Commerce, Mobile Computing, Wireless Web, Web Security, Infrastructure Requirement For E – Commerce.
Business Models of e – commerce : Model Based On Transaction Type, Model Based On Transaction Party - B2B, B2C, C2B, C2C, E – Governance.

E – strategy: Overview, Strategic Methods for developing E – commerce.
Four C's : (Convergence, Collaborative Computing, Content Management & Call Center).
Convergence: Technological Advances in Convergence – Types, Convergence and its implications, Convergence & Electronic Commerce.
Collaborative Computing : Collaborative product development, contract as per CAD, Simultaneous Collaboration, Security.

Module 2: [12 Hrs]

Content Management : Definition of content, Authoring Tools & Content Management, Content – partnership, repositories, convergence, providers, Web Traffic & Traffic Management; Content Marketing.

Call Center : Definition, Need, Tasks Handled, Mode of Operation, Equipment , Strength & Weaknesses of Call Center, Customer Premises Equipment (CPE).

Supply Chain Management : E – logistics, Supply Chain Portal, Supply Chain Planning Tools (SCP Tools), Supply Chain Execution (SCE), SCE - Framework, Internet's effect on Supply Chain Power.

E – Payment Mechanism : Payment through card system, E – Cheque, E – Cash, E – Payment Threats & Protections. E – Marketing:. Home –shopping, E-Marketing, Tele-marketing

Electronic Data Interchange (EDI) : Meaning, Benefits, Concepts, Application, EDI Model, Protocols (UN EDI FACT / GTDI, ANSI X – 12), Data Encryption (DES / RSA).

Risk of E – Commerce : Overview, Security for E – Commerce, Security Standards, Firewall, Cryptography, Key Management, Password Systems, Digital certificates, Digital signatures.

Module 3: [14 Hrs]

Introduction to ERP: Common ERP myths, Evolution of ERP, Advantages, Characteristics, Process integration with ERP system, Implementation costs, Roadmap for successful ERP implementation.

ERP Market and Vendors: ERP market, ERP vendors, Service oriented architecture, ERP package features.

Extended ERP services: Defining Extended ERP, Supply chain Management (SCM) and ERP, ERP and Business Intelligence (BI), ERP and E-commerce.

Business Process Re-engineering (BPR) and ERP: Defining BPR, BPR Vs TQM, BPR and change management, approaches in BPR implementation, Methodologies for BPR implementation, BPR success/failure factors.

Planning for ERP: Planning for ERP implementation, understanding organizational requirement, Economic and strategic justification, Project scope, Determining resources, organizational commitment to change, budget for ERP, select right ERP package.

Implementation of ERP: Designs of ERP system, ERP implementation approach, ERP implementation life cycle, different phases of ERP implementation

Managing ERP projects: Risk/Failure factors in ERP implementation, Example of ERP failure, Critical success factors, Complexities of ERP projects, Evaluating ERP projects.

ERP: Going Live and post implementation: Preparing to go live, Strategies for migration to new ERP system, Managing ERP after Go Live, Maintenance of ERP system.

ERP, Internet and WWW – ERP II: The internet explosion, ERP, Internet and WWW, ERP to ERP II, Best practices of ERP II.

Future directions and Trends in ERP: New markets, New channels, Easier communication tools, Business models, Need based applications, Expenditures, Reduction in implementation time, Market snap shots, Shifting revenue models

Suggested Books:

1. David Whitley:"E-Commerce-Strategy, Technologies & Applications", TMH.
2. Kamlesh K. Bajaj:"E-Commerce- The cutting edge of business", TMH.
3. W Clarke: "E-Commerce through ASP", BPB.

4. Mathew Reynolds, Wrox:"Beginning E-Commerce with VB, ASP, SQL Server 7.0 & MTS",WROX Press Ltd.
5. J. Christopher Westland and Theodore H. K Clark:"Global Electronic Commerce- Theory and Case Studies", University Press.
6. Enterprise Resource Planning, Ashim Raj Singla, Cengage Learning India Pvt. Ltd., New Delhi, 2008.
7. Alexis Leon: "Enterprise Resource Planning", 2nd edition, Tata Mcgraw Hill Education Pvt. Ltd., NewDelhi, 2008.
8. Grant Norris, James R. Hurley, Kenneth M.Hartley, John R. Dunleavy, John D. Balls: "E-Business and ERP: Transforming the Enterprise",John Wiley and Sons, 2000.
9. V.K. Garg: "Enterprise Resource Planning: Concepts and Practice", Wiley.

Project – I

Code: CSEUGPC24
Contacts: 8P
Credits: 4

Summer Internship ***

Code: CSEUGPC24
Contacts: 0
Credits: 2

Machine Learning & Soft Computing Lab

Code: CSEUGPC24
Contacts: 3P
Credits: 1.5

Course outcomes:

CO 1: Implement fuzzy set operations, membership functions, and fuzzy systems using MATLAB.
CO 2: Design and apply neural network models (e.g., perceptron, Adaline, Madaline) for simple logic functions using MATLAB.
CO 3: Utilize genetic algorithms in MATLAB to solve optimization problems, including the Traveling Salesman Problem (TSP).
CO 4: Develop clustering algorithms (k-means, hierarchical, density-based) and validate them using R for unsupervised learning.
CO 5: Perform dimensionality reduction using PCA and apply classification techniques (SVM, k-NN, Decision Trees, Naïve Bayes) in R for predictive analytics.

CO – PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12
CO1	3	2	3									2
CO2	3	2	3								2	2
CO3	2	3	2							2		3
CO4	2		3		2							2
CO5	3	2	3						2			3

In this laboratory students need to perform programming in Matlab and R.
A sample assignment list is given below:
Fuzzy set: Matlab program to implement the different Fuzzy Membership functions, Fuzzy set operations and its properties, composition of Fuzzy and Crisp Relations, Fuzzy Information System (using GUI based Fuzzy toolbox)
Neural network: Write Matlab code to implement McCulloh-Pitts neural network for generate AND, OR functions, Perceptron learning for particular, OR function with bipolar inputs and targets using Adaline network, XOR function with bipolar inputs and targets using Madaline, McCulloh-Pitts model to generate AND, OR functions.
Genetic Algorithm : Write a Matlab code for implementing Genetic Algorithm and solve several optimization problems. Perform GA to implement TSP problem.
Clustering: Write R code to implement different clustering algorithm such as k-means, hierarchical, density based. R code to validate clustering algorithms (clustering validity index such as DB index, Dunn index, XB index etc).
R code to implement **Principal Component Analysis (PCA)** and applied it to reduce high dimensional data.
Classification: R code to implement different classification technique such as SVM, K-nn, Tree based classifier, Naïve-baye's etc. Implement R code to classify different dataset and plot ROC curve and accuracy.

Soft Skills

Code: MBAUGHU03
Contacts: 3P
Credits: 0

Course outcomes:

CO 1: Demonstrate effective verbal and non-verbal communication skills, including listening, correct pronunciation, and intonation.
CO 2: Apply techniques such as SWOT Analysis, STAR method, and principles of body language to excel in mock interview sessions.
CO 3: Develop confidence, presentation skills, and professional etiquette for enhanced personality development.
CO 4: Effectively manage time and prioritize tasks to improve personal productivity.
CO 5: Demonstrate teamwork, collaboration, and leadership skills through team dynamics exercises and role plays.

CO – PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12
CO1	2								3	3		
CO2			2						3	3		
CO3						2			3	3		
CO4			3							2		
CO5			3					2	3	3		

Basic Communications Skills: Verbal and non-verbal communications, Correct Pronunciations, Listening skills, Intonations

Mock Interview Session: Three Vs of interview, SWOT Analysis, STAR Techniques, Five Ts principle of Life

Personality Development, Confidence building, Body Language-Positive and Negative body language, Postures,Gestures, Appearance and Presentation skills. Presentation abilities, Nature vs. NurtureIndividualCounseling& Feedback

Time Management: Managing your time effectively, Setting things on priorities

Team management and team dynamics, Team Work, Role Plays, Game Planning, Co-ordination

Etiquettes, Business Etiquettes, Email Etiquettes, Resume Writing

Suggested Books:

1. E. Suresh Kumar:"Communication Skills and Soft Skills", Pearson.
2. John Sonmez:"Soft Skills: The software developer's life manual", Manning Publications.
3. Prof. M.S. Rao: "Soft Skills for Young Managers", Dreamtech Press.
4. Emma-Sue Prince:"The Advantage: The 7 soft skills you need to stay one step ahead", Pearson.

Semester VIII:

Cryptography and Network Security

Code: CSEUGPC26
Contacts: 3L
Credits: 3

Course Outcomes:

- **CO 1:** Explain fundamental concepts of cryptography, information security, and various types of attacks.
- **CO 2:** Apply symmetric and asymmetric encryption algorithms, including DES, IDEA, RC5, and RSA, for securing data.
- **CO 3:** Analyze digital signatures, message digests, and hash functions for data integrity and authentication.
- **CO 4:** Demonstrate the use of Internet security protocols and authentication mechanisms such as SSL and biometric systems.
- **CO 5:** Illustrate the principles of email security, firewalls, and their configurations to enhance network security.

CO – PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12
CO1	3									2		
CO2	3		2									
CO3	2				3							
CO4	2	3				2						
CO5	2		3				2			3		

Module 1: [14 Hrs]
Introduction and Mathematical Foundations: Introduction, Overview on Modern Cryptography, Number Theory Probability and Information Theory, Attacks on Computers & Computer Security Introduction, Need for Security, Security approaches, Principles of Security, Types of attack.
Cryptography: Concepts & Techniques. Introduction, Plaintext & Cipher text, Substitution Techniques, Transposition Techniques, Encryption & Decryption, Symmetric & Asymmetric key Cryptography, Key Range & Key Size

Module 2 [14 hrs]
Symmetric Key Algorithm: Introduction, Algorithm types & Modes, Overview of Symmetric Key Cryptography, DES(Data Encryption Standard) algorithm, IDEA(International Data Encryption Algorithm) algorithm, RC5 (Rivest Cipher 5) algorithm.
Asymmetric Key Algorithm: Digital Signature and RSA: Introduction, Overview of Asymmetric key Cryptography, RSA algorithm, Symmetric & Asymmetric key Cryptography together, Digital Signature, Basic concepts of Message Digest and Hash Function (Algorithms on Message Digest and Hash function not required).

Module 3 [10 hrs]
Internet Security Protocols, User Authentication: Basic Concepts, SSL protocol, Authentication Basics, Password, Authentication Token, Certificate based Authentication, Biometric Authentication.
Electronic Mail Security: Basics of mail security, Pretty Good Privacy, S/MIME.
Firewall: Introduction, Types of firewall, Firewall Configurations, DMZ Network

Suggested Books:

1. William Stallings: "Cryptography and Network Security",6th Edition, Pearson Education, 2013.
2. MerikeKaeo: "Designing Network Security", 2nd Edition, Pearson Books.
3. Wade Trappe, Lawrence C Washington: "Introduction to Cryptography with coding theory", 2nd Ed, Pearson, 2007.
4. William Stallings: "Network Security Essentials: Applications and Standards", Pearson Education.
5. Behrouz A. Ferouzan: "Cryptography & Network Security", Tata Mc Graw Hill, 2007.
6. Man Young Rhee: "Internet Security: Cryptographic Principles, Algorithms and Protocols", Wiley Publications, 2003.
7. Douglas R Simson: "Cryptography – Theory and practice", First Edition, CRC Press, 1995.

Professional Values and Ethics

Code: MBAUGHU02
Contacts: 2L
Credits: 2

Course Outcomes:

CO 1: Explain the concepts of human values, ethics, integrity, and their relevance in personal and professional contexts.
CO 2: Analyze various moral dilemmas, ethical theories, and professional responsibilities specific to engineering.
CO 3: Demonstrate the importance of safety, risk assessment, and ethical decision-making in engineering practices.
CO 4: Assess the impact of globalization, environmental concerns, and computer ethics on professional practices.
CO 5: Apply ethical principles in handling real-world issues such as intellectual property rights, whistleblowing, and human rights in the workplace.

CO – PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12
CO1	3					2				3		
CO2	3	2								2		
CO3	2		3			3						
CO4	2			3	2							
CO5	2	3					3		2	3		

Unit 1 – Human Values [5 Hrs]
Objectives , Morals ,Values , Ethics , Integrity, Work ethics, Service learning , Virtues, Respect for others , Living peacefully, Caring , Sharing, Honesty, Courage, Valuing time , Cooperation , Commitment , Empathy, Self-confidence, Challenges in the work place ,Spirituality.

Unit 2 – Engineering Ethics [5 Hrs]
Overview, Senses of engineering ethics , Variety of moral issues , Types of inquiries , Moral dilemma , Moral autonomy , Moral development (theories) , Profession , Models of professional roles ,Theories about right action (Ethical theories)

Unit 3 – Engineering as Social Experimentation [4 Hrs]
Engineering as experimentation, Engineers as responsible experimenters, Codes of ethics, Industrial standards.

Unit 4 – Safety, Responsibilities and Rights [5 Hrs]
Safety definition, Safety and risk, Risk analysis, Assessment of safety and risk, Conflict of interests, Occupational crime, Human rights, Employee rights, Whistle blowing, Intellectual property rights.

Unit 5 – Global Issues [5 Hrs]
Globalization, Multinational corporations, Environmental ethics, Computer ethics, Engineers as managers, Engineers as advisors in planning and policy making, Moral leadership, Codes of ethics.

Suggested Books:

1. R.S. Naagarazan:“A Textbook of Professional Ethics and Human Values”, New Age International Publishers.
2. Dr.SubirChowdhury:“Blending the best of the East & West”, EXCEL.
3. Ghosh, VIKAS: “Ethics & Mgmt. & Indian Ethos”,
4. Pherwani:“Business Ethics”,EPH.
5. Balachandran, Raja, Nair:“Ethics, Indian Ethos & Mgmt.”, Shroff Publishers.
6. Velasquez:“Business Ethics: concept and cases”, Pearson.

ELECTIVE – IV

CAD for VLSI

Code: CSEUGPE20
Contacts: 3L
Credits: 3

Course Outcomes:

CO 1: Recognize different electronic circuits like Transistor, Registers, MOS.
CO 2: Distinguish between different partitioning algorithms.
CO 3: Apply the basic knowledge of CAD to design VLSI circuits.
CO 4: Testing of all patterns generated.
CO 5: Create a new design, starting from formulation of a problem to implementations.
CO 6: Solving problems and observing the nature of any VLSI circuit.

CO – PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12
CO1	2											
CO2	1	2								1		
CO3			2	1					1			
CO4	1		1	2	1						1	1
CO5	1	2	3			2				2		
CO6		2		2								1

MODULE - I
Introduction [5L]
VLSI technology, MOS Transistor & Switches, Layout of basic devices- Inverter, NAND, NOR, Compound gates, Multiplexer, Memory-Latches & Register.

MODULE - II
Overview of VLSI Design cycle [4L]
System specification; Design- Functional, Logic, Circuit, Physical; Fabrication, Design methodologies, Packaging; Design styles- Full custom, Standard cell, Gate arrays FPGA;

Partitioning [4L]
Problem formulation, Approximation of hyper graphs with graphs, Kerninghan-Lin & Fiduccia- Mattheyses heuristic algorithm, Ratio cut.

Placement [4L]
Cost function, Force directed methods, Partitioning placement, Resistive network, Regular & linear placement.

Floorplanning [4L]
Problem formulation, Hierarchical approach, Rectangular dualization, Floorplan sizing.

MODULE - III
Routing [8L]
Global- Problem formulation; Fundamentals- Maze running, Line searching, Steiner trees; Lee & line probe algorithm, Hierarchical approach,Randomized routing; Detailed- Problem formulation, Channel routing & Switchbox routing, Hierarchical approach, Greedy algorithm; Single layer-General river routing algorithm; Two layer- Left edge algorithm (Basic & Dogleg); Constraint graph- Yoshimura &Kuh algorithm.

Module-IV
Testing [7L]
Need for testing- Functionality & Manufacturing test; Manufacturing test principles- Stuck At, short & open circuit, Observability, controllability, Fault coverage; Automatic test pattern generation, Design strategies for test- Scan based, Self test.

Suggested Books:

1. Naved A. Sherwani: "Algorithms ForVLSI Physical Design Automation", Kulwer Academic.
2. M Sarafzadeh&C.K.Wong: "An Introduction to VLSI Physical Design",TMH.
3. Sujata Pandey& Manoj Pandey:"VLSI Design", DhanpatiRai& Co.
4. Bhasker: "A VHDL Primer", PE.Publisher.
5. Douglas L. Pery: "VHDL Programming by Example", TMH.
6. B. Abrhamkhi: "Digital Testing",
7. S.H. Gerez:"Algorithms for VLSI Design Automation", Wiley-India, 1999.

Distributed Systems

Code: CSEUGPE21
Contacts: 3L
Credits: 3

Course Outcomes:

CO1 Understand the Fundamentals and Challenges of Distributed Systems
CO2 Analyze Operating System Structures for Distributed Environments
CO3 Implement Inter-Process Communication and Remote Invocation Techniques
CO4 Apply Distributed Mutual Exclusion and Deadlock Detection Algorithms
CO5 Evaluate Protection and Security Mechanisms in Distributed Systems
CO6 Design and Analyze Distributed File Systems and Shared Memory

CO-PO mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3	2			2					
CO2	3	3		2	2					
CO3	3		3	2	3					
CO4	3	3	3	2	3					
CO5	3	2		2	3	3				2
CO6	3	3	3	2	3					

Module 1 [12 hrs]
Introduction to Distributed System
Introduction, Examples of distributed system, Resource sharing, Challenges

Operating System Structures:
Review of structures: monolithic kernel, layered systems, virtual machines. Process based models and client server architecture; The micro-kernel based client-server approach.

Communication:
Inter-process communication, Remote Procedure Call, Remote Object Invocation, Tasks and Threads. Examples from LINUX, Solaris 2 and Windows NT.

Theoretical Foundations:
Introduction.Inherent Limitations of distributed Systems.Lamport's Logical clock. Global State

Module 2 [12 Hrs]
Distributed Mutual Exclusion:
Classification of distributed mutual exclusion algorithm. Non Token based Algorithm: Lamport's algorithm, Ricart-Agrawala algorithm. Token based Algorithm: Suzuki-Kasami's broadcast algorithm.

Distributed Deadlock Detection:
Deadlock handling strategies in distributed systems. Control organizations for distributed deadlock detection. Centralized and Distributed deadlock detection algorithms: Completely Centralized algorithms, path pushing, and edge chasing, global state detection algorithm.

Protection and Security:
Requirements for protection and security regimes. The access matrix model of protection. System and user modes, rings of protection, access lists, capabilities. User authentication, passwords and signatures. Use of single key and public key encryption.

Module 3 [12 Hrs]
Distributed file systems:
Issues in the design of distributed file systems: naming, transparency, update semantics and fault resilience. Use of the Virtual File System layer. Examples of distributed systems including Sun NFS, the Andrew file store, CODA file system and OSF DCE

Distributed Shared Memory:
Architecture and motivations.Algorithms for implementing DSM. Memory Coherence

CORBA:
The Common Object Request Broker Architecture model and software and its relationship to Operating Systems

Suggested Books:

1. George Coulouris, Jean Dollimore, Tim Kindberg: "Distributed Systems: Concepts and Design", 4th Edition, Pearson Education.
2. A.S. Tanenbaum and M. V. Steen: "Distributed Systems: Principles and Paradigms", Second Edition, Prentice Hall.

3. M.L. Liu: “Distributed Computing Principles and Applications”, Pearson Addison Wesley.
4. MukeshSinghal: “Advanced Concepts In Operating Systems”, McGrawHill Series in Computer Science.
5. Nancy A. Lynch: "Distributed Algorithms", The Morgan Kaufmann Series in Data Management System, Morgan Kaufmann Publishers.

Operations Research

Code: CSEUGPE22
Contacts: 3L
Credits: 3
Course Outcomes:

CO 1: Define and formulate linear programming problems and appreciate their limitations.
CO 2: Solve linear programming problems using appropriate techniques and optimization solvers, interpret the results obtained and translate solutions into directives for action.
CO 3: Achieve expertise in strategy making by solving various games.
CO 4: Develop mathematical skills to analyze and solve integer programming and network models arising from a wide range of applications.
CO 5: Effectively communicate ideas, explain procedures and interpret results and solutions in written and electronic forms to different audiences.
CO 6: Differentiate characteristics of different types of decision-making problem to formulate and solve a real-world problem a prototype of mathematical problem.

CO – PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12
CO1	2	2										
CO2	1	3	3	2						1		2
CO3	3	2	2	2					1			1
CO4	1	2	3			2			1			1
CO5						2				3		
CO6		2	2	3								2

UNIT-I: [2 Hrs]
Linear Programming Problems (LPP): Basic LPP and Applications; Various Components of LP Problem Formulation.

UNIT-II: [10 Hrs]
Solution of Linear Programming Problems: Solution of LPP: Using Simultaneous Equations and Graphical Method; Definitions: Feasible Solution, Basic and non-basic Variables, Basic Feasible Solution, Degenerate and Non-degenerate Solution, Convex set and explanation with examples. Solution of LPP by Simplex Method; Charnes’ Big-M Method; Duality Theory.Transportation Problems and Assignment Problems.

UINT-III: [6 Hrs]

Game Theory: Introduction; 2-Person Zero-sum Game; Saddle Point; Mini-Max and Maxi-Min Theorems (statement only) and problems; Games without Saddle Point; Graphical Method; Principle of Dominance.

UNIT-IV: [8 Hrs]
Network Analysis: Shortest Path: Floyd Algorithm; Maximal Flow Problem (Ford-Fulkerson); PERT-CPM (Cost Analysis, Crashing, Resource Allocation excluded).

UNIT-V: [8 Hrs]
Inventory Control: Introduction to EOQ Models of Deterministic and Probabilistic; Safety Stock; Buffer Stock.

UNIT-VI: [8 Hrs]
Queuing Theory: Introduction; Basic Definitions and Notations; Axiomatic Derivation of the Arrival & Departure (Poisson Queue). Poisson Queue Models: (M/M/1): (∞ / FIFO) and (M/M/1: N / FIFO) and problems.

Suggested Books:

1. H. A. Taha: "Operations Research", Pearson.
2. P. M. Karak: "Linear Programming and Theory of Games", ABS Publishing House.
3. Ghosh and Chakraborty: "Linear Programming and Theory of Games", Central Book Agency.
4. Ravindran, Philips and Solberg: "Operations Research", WILEY INDIA.
5. KantiSwaroop: "Operations Research", Sultan Chand & Sons.

High Performance Computer Architecture

Code: CSEUGPE23
Contacts: 3L
Credits: 3

Course Outcomes:

CO 1: Analyze parallelism and pipelining techniques.
CO 2: Apply concepts to develop parallel processing systems
CO 3: Apply the concept of different design techniques of interconnection network
CO 4: Design shared memory architecture.
CO 5: Analyze the fundamentals of embedded system architecture

CO – PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12
CO1		3										
CO2	3		2									
CO3	3											

CO4			**3**									
CO5		**3**										

UNIT I [3 Hrs]
Introduction:
Review of basic computer architecture, quantitative techniques in computer design, measuring and reporting performance.

UNIT II [2 Hrs]
CISC and RISC processors.

UNIT III [10 Hrs]
Pipelining: Basic concepts, instruction and arithmetic pipeline, data hazards, control hazards, and structural hazards, techniques for handling hazards.Exceptionhandling.Pipeline optimization techniques.

Compiler techniques for improving performance. Hierarchical memory technology: Inclusion, Coherence and locality properties; Cache memory organizations, Techniques for reducing cache misses;

UNIT IV [4 Hrs]
Virtual memory organization, mapping and management techniques, memory replacement policies.

UNIT V [6 Hrs]
Instruction-level parallelism: basic concepts, techniques for increasing ILP, superscalar, super-pipelined and VLIW processor architectures. Array and vector processors.

UNIT VI [6 Hrs]
Multiprocessor architecture: taxonomy of parallel architectures. Centralized shared-memory architecture: synchronization, memory consistency, interconnection networks.

UNIT VII [5 Hrs]
Distributed shared-memory architecture. Cluster computers. Non von Neumann architectures: data flow computers, reduction computer architectures, systolic architectures.

Suggested Books:

1. John L. Hennessy and David A. Patterson:“Computer Architecture: A Quantitative Approach”, Morgan Kaufmann.
2. John Paul Shen and Mikko H. Lipasti:“Modern Processor Design: Fundamentals of Superscalar Processors”, Tata McGraw-Hill.
3. M. J. Flynn:“Computer Architecture: Pipelined and Parallel Processor Design”, Narosa Publishing House.
4. Kai Hwang:“Advanced Computer Architecture: Parallelism, Scalability, Programmability”, McGraw-Hill.
5. John Hennessy and David Patterson: “Computer Architecture: A Quantitative Approach”, 4th Edition,Morgan Kaufmann.

Real Time Systems

Code: CSEUGPE24
Contacts: 3L
Credits: 3

Course Outcomes:

CO 1: Explain the fundamental concepts, structure, and performance measures of real-time systems.
CO 2: Apply scheduling algorithms and task assignment techniques for real-time systems, including fault-tolerant scheduling.
CO 3: Utilize programming languages and tools suited for real-time applications, focusing on multitasking and task scheduling.
CO 4: Analyze real-time databases and communication protocols, emphasizing fault tolerance and concurrency control.
CO 5: Evaluate reliability and synchronization techniques in real-time systems, considering hardware and software fault tolerance.

CO – PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12
CO1	3									2		
CO2	3	3	2			2						
CO3	3	2									2	
CO4	2			3		3						
CO5	2	2			2		2					

Module-1 [8 Hrs]
Introduction:
Introduction - Issues in Real Time Computing, Structure of a Real Time System. Task Classes, Performance Measures for Real Time Systems, Estimating Program Run times. Task Assignment and Scheduling - Classical Uniprocessor scheduling algorithms, UniProcessor scheduling of IRIS Tasks, Task Assignment, Mode Changes, and Fault Tolerant Scheduling.

Module-2 [7 Hrs]
Programming languages and tools:
Programming Language and Tools – Desired Language characteristics, Data Typing, Control structures, Facilitating Hierarchical Decomposition, Packages, Run-time (Exception) Error handling, Overloading and Generics, Multitasking, Low Level programming, Task scheduling, Timing Specifications, Programming Environments, Run-time Support.

Module-3 [7 Hrs]
Real time databases:
Real time Databases - Basic Definition, Real time Vs General Purpose Databases, Main Memory Databases, Transaction priorities, Transaction Aborts, Concurrency Control Issues, Disk Scheduling Algorithms, Two-phase Approach to improve Predictability, Maintaining Serialization Consistency, Databases for Hard Real Time systems.

Module-4 [7 Hrs]
Communication:

Real-Time Communication - Communications Media, Network Topologies Protocols, Fault Tolerant Routing. Fault Tolerance Techniques - Fault Types, Fault Detection. Fault Error containment Redundancy, Data Diversity, Reversal Checks, Integrated Failure handling.

Module-5 [7 Hrs]
Evaluation techniques:
Reliability Evaluation Techniques - Obtaining Parameter Values, Reliability Models for Hardware Redundancy, Software Error models. Clock Synchronization - Clock, ANonfault-Tolerant Synchronization Algorithm, Impact of Faults, Fault Tolerant Synchronization in Hardware, Fault Tolerant Synchronization in Software

Suggested Books:

1. C.M. Krishna, Kang G. Shin: "Real-Time Systems", McGraw-Hill International Editions, 1997.
2. Stuart Bennett: "Real Time Computer Control-An Introduction",Second edition Perntice Hall PTR, 1994.
3. Peter D. Lawrence: "Real time Micro Computer System Design – An Introduction", McGraw Hill, 1988.
4. S.T. Allworth and R.N. Zobel: "Introduction to real time software design", Macmillan, II Edition, 1987.
5. R.J.A Buhur, D.L. Bailey: "An Introduction to Real-Time Systems", Prentice-Hall International, 1999.
6. Philip.A.Laplante: "Real Time System Design and Analysis", PHI, III Edition, April 2004.

Digital Topology

Code: CSEUGPE25
Contacts: 3L
Credits: 3

Course Outcomes:

CO 1: Explain the fundamental concepts of digital spaces, including continuity, contour tracing, and topology-preserving operations.
CO 2: Apply neighborhood concepts, digital paths, and metric spaces to analyze 2D and 3D digital structures.
CO 3: Implement distance transforms, skeletonization algorithms, and boundary computations for digital image processing.
CO 4: Analyze topological transformations, homotopic trees, and the characteristics of simple points in 3D digital spaces.
CO 5: Apply topological methods like region growing, watershed transforms, and minimal path techniques for image segmentation.

CO – PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12
CO1	3									2		
CO2	3	2										
CO3	3	3	2									
CO4	3	2										
CO5	3	3	3									

Module I (8 Hours)
Introduction, basic ingredients, concept of 2D/3D digital space, continuity, contour tracing, chain code, topology preserving operations – skeletonization and adjacency tree, Euler characteristics, connected component labelling, adjacency graph construction

Module II (6 Hours)
Metric space, neighborhood concepts in 2D/3D, digital path, fuzzy path-definition and notations, path lengths, digital straightness concepts, polygonal approximation

Module III (8 Hours)
Distance Transform, Medial Axis Transform, Shrinking binary images, Skeletonization Algorithm, Skeletons of planar patterns, Boundaries in digital space, Connected, oriented, closed boundaries in digital space, Computation of normal at boundary points, Computation of cross-sections of 3D objects

Module IV (8 Hours)
Homotopic tree, Voronoineighborhood, Surface voxelization, Topological transformation and topological equivalence, simple point, characteristics of simple points in 3D, local topological numbers

Module V (6 Hours)
Topological Approaches to Image Segmentation: Region Growing, Watershed, and Minimal Path; Dam construction, Watershed transform

Suggested Books and References:

1. Topological algorithms for digital image processing by T. Y. Kong and A. Rosenfeld, Elsevier
2. Topology of Digital Images by J. F. Peters, Springer
3. Digital Geometry in Image Processing by J. Mukhopadhyay, P. P. Das, S. Chattopadhyay, P. Bhowmick, B. N. Chatterji, CRC Press

ELECTIVE – V

Adhoc& Sensor Networks

Code: CSEUGPE26
Contacts: 3L
Credits: 3

Course Outcomes:

CO 1: Explain the fundamentals of wireless networks, including Mobile Ad-hoc Networks (MANETs) and Wireless Sensor Networks (WSNs), and analyze their characteristics, challenges, and applications.

CO 2: Understand the hardware architecture of sensor nodes, energy consumption, communication protocols, and optimization techniques in WSNs.

CO 3: Apply routing protocols and data aggregation techniques to enhance communication efficiency in WSNs.

CO 4: Implement infrastructure establishment techniques, including topology control, synchronization, and localization for efficient sensor network design.

CO 5: Utilize sensor network platforms and tools such as TinyOS, nesC, and NS2 for programming and simulation of sensor networks.

CO – PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12
CO1	3	2										
CO2	3	3										
CO3	3	2	3									
CO4	3	3	2									
CO5	3	2	3	2								

Module-1: Introduction and Overview: [12 Hrs]

Overview of wireless networks, types, infrastructure-based and infrastructure-less, introduction to MANETs (Mobile Ad-hocNetworks), characteristics, reactive and proactive routing protocols with examples, introduction to sensor networks, commonalities and differences with MANETs, constraints and challenges, advantages, applications, enabling technologies for WSNs.

Module-2: Architectures & Communication Protocols [12 Hrs]

Single-node architecture - hardware components, design constraints, energy consumption of sensor nodes, operating systems and execution environments, examples of sensor nodes, sensor network scenarios, types of sources and sinks – single hop vs. multi hop networks, multiple sources and sinks – mobility, optimization goals and figures of merit, gateway concepts, design principles forWSNs, service interfaces for WSNs.

Physical layer and transceiver design considerations, MAC protocols for wireless sensor networks, routing protocols- classification, gossiping, flooding, energy-efficient routing, unicast protocols, multi-path routing,data-centric routing, data aggregation, SPIN, LEACH, Directed-Diffusion, geographic routing.

Module-3: Infrastructure Establishment & Sensor Network Platforms and Tools [12 Hrs]

Topology control, flat network topologies, hierarchical networks by clustering, time synchronization, properties, protocols based on sender-receiver and receiver-receiver synchronization, LTS, TPSN, RBS, HRTS, localization and positioning, properties and approaches, single-hop localization, positioning in multi-hop environment, range based localization algorithms – location services,sensor tasking and control.

Sensor node hardware, Berkeley motes, programming challenges, node-level software platforms, node-level simulators, state-centric programming, Tiny OS, nesC components, NS2 simulator, TOSSIM.

Suggested Books:

1. Holger Karl & Andreas Willig: "Protocols and Architectures for Wireless Sensor Networks", John Wiley, 2005.
2. Feng Zhao & Leonidas J. Guibas: "Wireless Sensor Networks- An Information Processing Approach", Elsevier, 2007.
3. KazemSohraby, Daniel Minoli, &TaiebZnati: "Wireless Sensor Networks- Technology, Protocols, and Applications", John Wiley, 2007.
4. Anna Hac: "Wireless Sensor Network Designs", John Wiley, 2003.
5. Thomas Haenselmann: "Sensor Networks", available online for free, 2008.
6. Edgar Callaway: "Wireless Sensor Networks: Architectures and Protocols", Auerbach, 2003.

Cloud Computing

Code: CSEUGPE27
Contacts: 3L
Credits: 3

Course Outcomes:

CO1 Understand the Fundamentals and Models of Cloud Computing
CO2 Analyze Cloud Architecture and Components
CO3 Apply Knowledge of Cloud Services and Applications by Type
CO4 Examine Virtualization and Load Balancing in Cloud Environments
CO5 Evaluate Cloud Services Provided by Leading Platforms (Google, AWS, Microsoft)
CO6 Understand Applications and Storage in Cloud Computing

CO-PO mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12
CO1	3	2			2							
CO2	3	3	2		2							
CO3	3		3		2							
CO4	3	2	3	2	3	2						
CO5	3	3		2	3							
CO6	3	2	3		3				2	2		

Module-1: [12 Hrs]
Definition of Cloud Computing: Defining a Cloud, Cloud Types – NIST model, Cloud Cube model, Deployment models (Public, Private, Hybrid and Community Clouds), Service models – Infrastructure as a Service, Platform as a Service, Software as a Service with examples of services/ service providers, Cloud Reference model, Characteristics of Cloud Computing – Benefits and advantages of Cloud Computing.

Cloud Architecture: A brief introduction on Composability, Infrastructure, Platforms, Virtual Appliances, Communication Protocols, Applications, Connecting to the Cloud by Clients.

Services and Applications by Type: IaaS – Basic concept, Workload, partitioning of virtual private server instances, Pods, aggregations; PaaS – Basic concept, tools and development environment with examples SaaS - Basic concept and characteristics, Open SaaS and SOA, examples of SaaS platform Identity as a Service (IDaaS) Compliance as a Service (CaaS)

Module-2: [12 Hrs]

Concepts of Abstraction and Virtualization: Virtualization technologies: Types of virtualization (access, application, CPU, storage), Mobility patterns (P2V, V2V, V2P, P2P, D2C, C2C, C2D, D2D); Load Balancing and Virtualization: Basic Concepts, Network resources for load balancing, Mention of The Google Cloud as an example of use of load balancing; Hypervisors: Virtual machine technology and types.

Use of Google Web Services: Discussion of Google Applications Portfolio – Indexed search, Dark Web, Aggregation and disintermediation, Productivity applications and service, Adwords, Google Analytics, Google Translate, a brief discussion on Google Toolkit (including introduction of Google APIs in brief), major features of Google App Engine service.

Use of Amazon Web Services: Amazon Web Service components and services: Amazon Elastic Cloud, Amazon Simple Storage system, Amazon Elastic Block Store, Amazon SimpleDB and Relational Database Service

Module-3: [12 Hrs]

Use of Microsoft Cloud Services: Windows Azure platform: Microsoft's approach, architecture, and main elements, overview of Windows Azure AppFabric, Content Delivery Network, SQL Azure, and Windows Live services.

Service Oriented Architecture: Basic concepts of message-based transactions, Protocol stack for an SOA architecture, Event-driven SOA, Enterprise Service Bus, Service catalogs.

Applications in the Cloud: Concepts of cloud transactions, functionality mapping, Application attributes, Cloud service, attributes, System abstraction and Cloud Bursting, Applications and Cloud APIs.

Cloud-based Storage: Cloud storage definition – Manned and Unmanned.

Webmail Services: Cloud mail services including Google Gmail, Mail2Web, Windows Live Hotmail, Yahoo mail, concepts of Syndication services.

Suggested Books:

1. Barrie Sosinsky: "Cloud Computing Bible", Wiley India Pvt. Ltd, 2013.
2. RajkumarBuyya, Christian Vecchiola, S. ThamaraiSelvi: "Mastering Cloud Computing", McGraw Hill Education (India) Private Limited, 2013.
3. Anthony T. Velte: "Cloud computing: A practical approach", Tata Mcgraw-Hill.
4. Miller: "Cloud Computing", Pearson.
5. Moyer: "Building applications in cloud: Concept, Patterns and Projects", Pearson.
6. Dr. Kumar Saurabh:"Cloud Computing – Second Edition", Wiley India.

Data Warehousing and Data Mining

Code: CSEUGPE28
Contacts: 3L
Credits: 3

Course Outcomes:

CO 1: Demonstrate an understanding of data mining concepts, including data pre-processing and data reduction methods.

CO 2: Apply association rule mining algorithms to discover patterns and relationships within large databases.

CO 3: Implement classification techniques and prediction models to analyze data sets and make informed decisions.

CO 4: Utilize dimensionality reduction techniques to improve data analysis efficiency and manage large data sets.

CO 5: Perform cluster analysis using various methods and evaluate data groupings for meaningful insights.

CO 6: Design and optimize data warehouse solutions, employing OLAP tools and data modeling techniques for effective data retrieval and analysis.

CO – PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12
CO1	3	3	3	2	2	-	-	-	1	1	-	2
CO2	3	3	3	3	2	-	-	-	2	1	-	2
CO3	3	3	3	3	3	-	-	-	2	1	-	2
CO4	3	3	3	2	2	-	-	-	1	1	-	3
CO5	3	2	2	3	2	-	-	-	2	1	-	2
CO6	3	3	3	2	3	-	-	-	2	1	2	2

Module-1 [12 Hrs]
Introduction to Data Mining
Overview, Motivation (for Data Mining), Data Mining-Definition & Functionalities,
Data Processing, Form of Data Pre-processing, Data Cleaning: Missing Values, Noisy Data,(Binning,Clustering, Regression, Computer and Human inspection),Inconsistent Data, Data Integrationand Transformation. Data Reduction:-Data Cube Aggregation, Dimensionality reduction

Association Rule Mining:
Mining Association Rules in Large Databases, Association rule mining,mining Single-Dimensional Boolean Association rules from Transactional Databases– AprioriAlgorithm, Mining Multilevel Association rules from Transaction Databases and Mining MultiDimensionalAssociation rules from Relational Databases.

Module-2 [12 Hrs]
Classification and Predictions:
What is Classification & Prediction, Issues regarding Classification and prediction, Decisiontree, Bayesian Classification, Classification by Back propagation, Multilayer feed-forwardNeural Network, Back propagation Algorithm, Classification methods K-nearest neighbour classifiers, Genetic Algorithm.

Dimensionality Reduction

Introduction Principal Components Analysis, Singular Value Decomposition, Multidimensional Scaling

Module-3 [12 Hrs]
Cluster Analysis:
Data types in cluster analysis, Categories of clustering methods, Partitioning methods.
Hierarchical Clustering- CURE and Chameleon, Density Based Methods-DBSCAN, OPTICS,
Grid Based Methods- STING, CLIQUE, Model Based Method –Statistical Approach, Neural Network approach, Outlier Analysis

Data Warehousing:
Overview, Definition, Delivery Process, Difference between DatabaseSystem and Data Warehouse, Multi Dimensional Data Model, Data Cubes, Stars, Snow Flakes,Fact Constellations, Concept hierarchy, Process Architecture, 3 Tier Architecture, Data Marting.
Aggregation, Historical information, Query Facility, OLAP function and Tools. OLAP Servers,ROLAP, MOLAP, HOLAP, Data Mining interface, Security, Backup and Recovery, TuningData Warehouse, Testing Data Warehouse.

Suggested Books:

1. P. Tan, M. Steinbach and V. Kumar: "Introduction to Data Mining", Addison Wesley, 2006.
2. J. Han and M. Kamber: "Data Mining: Concepts and Techniques", 2nd Edition, Morgan Kaufmann, 2006.
3. Arun K. Pujari: "Data Mining Techniques", Universities Press.

GIS & Remote Sensing
Code: CSEUGPE29
Contacts: 3L
Credits: 3

Course Outcomes:

CO 1: Retrieve the information content of remotely sensed data.
CO 2: Analyze the energy interactions in the atmosphere and earth surface features.
CO 3: Interpret the images for preparation of thematic maps.
CO 4: Apply problem specific remote sensing data for engineering applications.
CO 5: Analyze spatial and attribute data for solving spatial problems.
CO 6: Create GIS and cartographic outputs for presentation.

CO – PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12
CO1	2			1								
CO2		1	2			1						
CO3	2	2									1	
CO4			2						1			1
CO5	1	2		2						1		
CO6	2		3			2				2		

Module 1 [12 Hrs]
Fundamentals of remote sensing; Principles of electromagnetic radiation and EM spectrum.Sensors and platforms; remote sensing satellites, multispectral, hyper spectral and thermal sensors; RS data acquisition systems.Image processing; Image enhancement and visualization; Image interpretation and classification.Microwave thermal remote sensing; Radar & laser altimetry.

Module 2 [12 Hrs]
Applications of Remote Sensing; Integration of remote sensing and GIS.Basic concepts of GIS; cartographic principles, map projections and coordinate systems.Geographic information and spatial data types; Hardware and software; Steps of spatial data handling; Database management systems; Spatial referencing.

Module 3 [12 Hrs]
Data quality, measures of location errors on maps. Spatial data input, data preparation; Point data transformation.Analytical GIS capabilities, retrieval and classification, overlay functions.
Neighbourhood operations, network analysis, error propagation; Data visualization.

Suggested Books:

1. BurroughPA:"Principles of Geographic Information System for Land Resources Assessment", Oxford Univ. Press.
2. Curran PJ:"Principles of Remote Sensing", Longman.
3. Jensen JR:"Introductory Digital Image Processing", Prentice Hall.
4. Lillesand TM & Kiefer RW:"Remote Sensing and Image", Wiley.

Parallel Computing Techniques

Code: CSEUGPE30
Contacts: 3L
Credits: 3

Course Outcomes:

CO 1: Understand the hardware and software paradigms essential for parallel computing and analyze the differences between shared and distributed infrastructure.
CO 2: Apply parallel programming paradigms and architectures to design efficient parallel programs.
CO 3: Implement message-passing, multithreading, and OpenMP techniques to develop parallel applications using PRAM models.
CO 4: Apply computational strategies such as partitioning, divide-and-conquer, pipelining, and load balancing to optimize parallel computations.
CO 5: Utilize shared memory and message-passing interfaces (MPI), along with CUDA programming, for developing parallel algorithms for sorting, numerical computations, and image processing.

CO – PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12
CO1	3	2										
CO2	3	3	2									
CO3	3	3	2	3								
CO4	3	2	3	2								
CO5	3	2	3	3	3							

MODULE –I[4 Hrs]
Introduction:
Hardware and software paradigms, Shared infrastructure

MODULE – II [6 Hrs]
Parallel Programming Paradigms,ParallelArchitecture,Parallel Program Design

MODULE – III [8 Hrs]
Message-Passing Computing and Programming,Multithread Programming,Open Programming,Open MP&PRAM Model of Computation,PRAM.

MODULE – IV [7 Hrs]
Embarrassingly Parallel Computations,Partitioning and Divide-and-Conquer Strategies,PipelinedComputations,SynchronousComputations,Load Balancing and Termination Detection.

MODULE – V [5 Hrs]
Shared Memory & Message Passing,MPI,AlgorithmicTechniques,CUDA.

MODULE – VI [6 Hrs]
Sorting Algorithms,NumericAlgorithms,Image Processing Algorithm

Suggested Books:

1. M J Quinn: "Parallel Programming in C with MPI and OpenMP",
2. AnanthGrama, George Karypis, Vipin Kumar, and AnshulGupta:"Introduction to Parallel Computing", Pearson.
3. D. Kirk and W. Hwu: "Programming Massively Parallel Processors",Morgan Kaufman Publisher.
4. Michael Huth, Mark Ryan: "Logic in Computer Science Modelling and Reasoning about Systems", Cambridge University Press.