Department: Computer Science & Engineering
Curriculum Structure & Syllabus
(Effective from 2018-19 Admission Batch)

Under Autonomy (**GR A:** ECE, EE, EIE, BME; **GR B:** CSE, IT, ME, CE, FT)

1st Semester								
Sl No	**Course Type**	**Course Code**	**Theory**	**Contact Hours /Week**				**Credit Points**
				L	**T**	**P**	**Total**	
A. THEORY								
1	BS	M 101	Mathematics -I	3	1	0	4	4
2	BS	CH 101/ PH 101	Chemistry (Gr. A) / Physics- I (Gr. B)	3	0	0	3	3
3	ES	EE 101/ EC 101	Basic Electrical Engineering (Gr. A) / Basic Electronics Engineering (Gr. B)	3	0	0	3	3
4	HS	HU 101	English	2	0	0	2	2
Total of Theory							**12**	**12**
B. PRACTICAL								
5	BS	CH 191/ PH191	Chemistry Lab (Gr. A) / Physics- I Lab (Gr. B)	0	0	3	3	1.5
6	ES	EE 191/ EC 191	Basic Electrical Engineering Lab (Gr. A) / Basic Electronics Engineering Lab (Gr. B)	0	0	3	3	1.5
7	ES	ME 191/ ME 192	Engineering Graphics & Design (Gr A) / Workshop/Manufacturing Practices (Gr-B)	0	0	3	3	1.5
8	PROJ	PR 191	PROJECT-IA	0	0	1	1	0.5
9	PROJ	PR 192	PROJECT-IB	0	0	1	1	0.5
C. MANDATORY ACTIVITIES / COURSES								
10	MC	MC 181	Induction Program	0	0	0	0	
Total of Theory, Practical & Mandatory Activities/Courses							**22**	**17.5**

Course Name: Mathematics-I
Course Code: M 101
Contact: 3:1:0
Total Contact Hours: 48
Credits: 4

Prerequisites:

The students to whom this course will be offered must have the concept of (10+2) standard matrix algebra and calculus.

Course Objectives:

The objective of this course is to disseminate the prospective engineers with techniques in matrix algebra and calculus. It aims to equip the students with standard concepts and tools at an intermediate toadvanced level that will serve them well towards tackling more advanced level of mathematics and applications that they would find useful in their disciplines.

Course Outcome(s):

COs	DESCRIPTIONS
CO1	Recall the distinctive characteristics of matrix algebra and calculus.
CO2	Understand the theoretical working of matrix algebra and calculus.
CO3	Apply the principles of matrix algebra and calculus to address problems in their disciplines.
CO4	Examine the nature of system using the concept of matrix algebra and calculus.

Course Content:

Module I: Matrix Algebra (11)

Echelon form and Normal (Canonical) form of a matrix; Inverse and rank of a matrix; Consistency and inconsistency of system of linear equations, Solution of system of linear equations; Eigenvalues and eigenvectors; Diagonalization of matrices; Cayley-Hamilton theorem.

Module II: Differential Calculus and Infinite Series (10)

Rolle's Theorem, Mean value theorems, Taylor's and Maclaurin theorems with remainders; Concept of sequence and series, Tests for convergence of infinite series: Comparison test, D'Alembert's ratio test, Raabe's test, Cauchy's root test, Power series; Taylor's series, Series for exponential, trigonometric and logarithm functions.

Module III: Multivariable Calculus (Differentiation) - I (9)

Function of several variables, Concept of limit, continuity and differentiability; Partial derivatives, Total derivative and its application; Chain rules, Derivatives of implicit functions Euler's theorem on homogeneous function, Jacobian.

Module IV: Multivariable Calculus (Differentiation) - II (7)

Maxima and minima of functions of two variables, Method of Lagrange multipliers; Directionalderivatives, Gradient, Divergence, Curl.

Module V: Integral Calculus (11)

Evolutes and involutes; Evaluation of definite integrals and its applications to evaluate surface areasand volumes of revolutions; Improper integrals; Beta and Gamma functions and their properties.

Textbooks:

1. Kreyszig, E., Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
2. Ramana, B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint,2010.
3. Veerarajan, T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008.
4. Grewal, B.S., Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010.
5. Bali, N.P. and Goyal, M., A text book of Engineering Mathematics, Laxmi Publications,Reprint, 2008.

Reference Books:

1. Thomas, G.B. and Finney, R.L., Calculus and Analytic geometry, 9th Edition, Pearson, Reprint, 2002.
2. Apostol, M., Calculus, Volumes 1 and 2 (2nd Edition), Wiley Eastern, 1980.
3. Kumaresan, S., Linear Algebra - A Geometric approach, Prentice Hall of India, 2000.
4. Poole, D., Linear Algebra: A Modern Introduction, 2nd Edition, Brooks/Cole, 2005.
5. Bronson, R., Schaum's Outline of Matrix Operations. 1988.
6. Piskunov, N., Differential and Integral Calculus, Vol. I & Vol. II, Mir Publishers, 1969

CO-PO Mapping:

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10	P11	P12
CO1	3	2	-	-	-	-	-	-	-	-	-	1
CO2	3	2	-	-	-	-	-	-	-	-	-	1
CO3	3	2	2	-	-	-	-	-	-	-	-	1
CO	2	3	1	-	-	-	-	-	-	-	-	1

Course Name: Physics –I
Course Code: PH 101
Contact: 3:0:0
Total Contact Hours: 36
Credits: 3

Prerequisites:

Knowledge of Physics up to 12^{th} standard.

Course Objective:

The aim of courses in Physics is to provide an adequate exposure and develop insight about the basic physics principles along with the possible applications. The acquaintance of basic principles of physics would help engineers to understand the tools and techniques used in the industry and provide the necessary foundations for inculcating innovative approaches. It can also create awareness of the vital role played by science and engineering in the development of new technologies. It also gives necessary exposure to the practical aspects, which is an essential component for learning sciences.

Course Outcome(s):

CO1: Describe various types mechanical resonance and its electrical equivalence
CO2: Explain basic principles of Laser, Optical fibers and various types of semiconductors
CO3: Apply superposition to explain interference and diffraction as well as apply wave mechanicsto attainment of Heisenberg's uncertainty principle
CO4: Analyze importance of light as a carrier of information and examine different crystallographic structures according to their co-ordination number and packing factors
CO5: Justify the need of a quantum mechanics as remedy to overcome limitations imposed by classical physics

Course Contents:

Module 1 (6L):

Waves & Oscillations:

Simple Harmonic Motion (only preliminary idea), damped harmonic motion-over damped, critically damped and under damped motion, energy decay, logarithmic decrement, force vibration and resonance(amplitude, velocity resonance), sharpness of resonance, quality factor, related numerical problems.

Module 2 (8L):

Classical Optics:

2.01- Interference of light: Huygens's principle, superposition of waves, conditions of sustained interference, Newton's ring (qualitative descriptions of working principles and procedures-no deduction required). Engineering applications, Numerical Problems.

2.02- Diffraction of light: Fresnel and Fraunhofer class, Fraunhoffer diffraction of a single slit,multiple slits, intensity distributions, missing order, Rayleigh criterion (no deduction) and resolving power of grating and microscope (no deduction), related numerical problems.

Module 3 (8L):

Quantum Mechanics-I:

3.01 Quantum Theory: Inadequacy of classical physics and its modifications by Planck's quantum hypothesis-qualitative (no deductions), particle concept of electromagnetic wave (example: photoelectric and Compton Effect; no derivation required, origin of modified and unmodified lines), wave particle duality; phase velocity and group velocity; de Broglie hypothesis; Davisson and Germer experiment.

3.02 Quantum Mechanics 1: Concept of wave function, physical significance of wave function, probability interpretation; normalization of wave functions; uncertainty principle, relevant numerical problems.

Module 4 (7L):

Solid State Physics-I:

4.01 Crystal Structure: Structure of solids, amorphous and crystalline solids (definition and examples), lattice, basis, unit cell, Fundamental types of lattices –Bravais lattice, simple cubic, fcc and bcc lattices, Miller indices and miller planes, co-ordination number and atomic packing factor, Bragg's equation, applications, numerical problems.

4.02 Semiconductor: Physics of semiconductors, electrons and holes, metal, insulator and semiconductor, intrinsic and extrinsic semiconductor, p-n junction.

Module 5 (7L):

Modern Optics-I:

5.01- Laser: Concepts of various emission and absorption process, Einstein A and B coefficients and equations, working principle of laser, metastable state, population inversion, condition necessary for active laser action, optical resonator, illustrations of Ruby laser, He-Ne laser, Semiconductor laser, applications of laser.

5.02-Fibre optics: Principle and propagation of light in optical fibres- Numerical aperture and Acceptance angle, Numerical problems.

Text Books:

Waves & Oscillations:

1. Sound-N. K. Bajaj (TMH)
2. Advanced Acoustics-D. P. Roy Chowdhury (Chayan Publisher)
3. Principles of Acoustics-B.Ghosh (Sridhar Publisher)
4. A text book of sound-M. Ghosh (S. Chand publishers)
5. A text book of Light- K.G. Mazumder & B.Ghoshs, (Book & Allied Publisher)
6. Physics of Oscillations and Waves- R.P. Singh
7. College Physics Vol. II - A.B. Gupta
8. Vibration, Waves and Acoustics- Chattopadhyay and Rakshit

Classical & Modern Optics:

1. A text book of Light- K.G. Mazumder & B.Ghoshs (Book & Allied Publisher)
2. A text book of Light-Brijlal & Subhramanium, (S. Chand publishers)
3. Modern Optics-A. B. Gupta (Book & Allied Publisher)
4. Optics-Ajay Ghatak (TMH)

5. Optics-Hecht
6. Optics-R. Kar, Books Applied Publishers
7. Physical Optics Möler
8. Optics -F.A. Jenkins and H.E White

Quantum Mechanics-I

1. Introduction to Quantum Mechanics-S. N. Ghoshal (Calcutta Book House)
2. Quantum Mechanics-Bagde and Singh (S. Chand Publishers)
3. Perspective of Quantum Mechanics-S. P. Kuilla (New Central Book Agency)
4. Quantum Mechanics-Binayak Datta Roy (S. Chand Publishers)
5. Quantum Mechanics-Bransden (Pearson Education Ltd.)
6. Perspective of Modern Physics-A. Beiser (TMH)
7. Quantum mechanics -A.K. Ghatak and S Lokenathan
8. Modern Physics -E.E. Anderson
9. Physics Volume 2 -Haliday, Resnick & Krane, Published by Wiley India

Solid State Physics-I:

1. Solid state physics-Puri & Babbar (S. Chand publishers)
2. Materials Science & Engineering-Kakani Kakani
3. Solid state physics- S. O. Pillai
4. Introduction to solid state physics-Kittel (TMH)
5. Solid State Physics and Electronics-A. B. Gupta and Nurul Islam (Book & Allied Publisher)
6. Problem in Solid state physics -S.O. Pillai (a. b.)

Reference Books:

1. Refresher courses in physics (Vol. 1, Vol. 2 & Vol. 3)-C. L. Arora (S. Chand Publishers)
2. Basic Engineering Physics-Amal Chakraborty (Chaya Prakashani Pvt. Ltd.)
3. Perspective & Concept of Modern Physics -Arthur Baiser
4. Principles of engineering physics – Md. N Khan and S Panigrahi.

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**3**	-	-	-	-	-	-	-	-	-	-	2
CO2	**3**	-	-	-	-	-	-	-	-	-	-	2
CO3	**3**	2	-	-	-	-	-	-	-	-	-	1
CO4	2	**3**	-	-	-	-	-	-	-	-	-	1
CO5	1	**3**	-	-	-	-	-	-	-	-	-	**1**

Course Name: Basic Electronics Engineering
Course Code: EC101
Contact: 3:0:0
Total Contact Hours: 36
Credits: 3

Prerequisites:

Electric current and voltage-D.C and A.C., Complex impedance, conductivity, resistivity, transformer charging and discharging of capacitor, active and passive elements.

Course Objective:

1. To understand the behavior of Conductors, Insulators, and Semiconductors based on energy-band theory and relevant problems.
2. To instill the knowledge of working principles of P-N Junction Diode, Zener diode and analyze their applications in the rectifier, clipper, clamper, regulator etc.
3. To familiarize with the characteristics of Bipolar junction transistor(BJT) under CE, CE, CC mode of operation and its biasing mechanisms.
4. To understand working principles of JFET, MOSFET and perform operations under CG, CS, CD configurations for parametric observation.
5. To determine the parameters due to the effect of feedback in amplifier to ,adder circuit , integrator and differentiator circuit using Operational Amplifier

Course Outcomes:

CO1	Students able to describe the fundamentals of Semiconductors
CO2	Students able to explain V-I characteristics of P-N Junction Diode, zener diode , working of diode rectifier, clipper, clamper, and regulator circuit
CO3	Students able to analyze characteristics of Bipolar junction transistor(BJT) under CE, CB, CC mode of operation and its biasing therein
CO4	Students able to illustrate the operations of JFET, MOSFET and the CS,CD , CG configuration using JFET
CO5	Students able to determine parameters due to effect of feedback in amplifier
CO6	Students able to construct inverting amplifier circuit , non-inverting amplifier circuit ,adder circuit , integrator and differentiator circuit using Operational Amplifier IC

Course Content:

Module-I: Basics of semiconductor (6L)

Conductors, Insulators, and Semiconductors- crystal structure, Fermi Dirac function, Fermi level,Energy band diagrams, valence band, conduction band, and band gap; intrinsic, and extrinsic (p-type and n-type) semiconductors, position of Fermi level in intrinsic and extrinsic semiconductor, drift and diffusion current – expression only (no derivation) , mass action law , charge neutrality in semiconductor, Einstein relationship in semiconductor , Numerical problems.

Module-II: P-N Junction Diode and its applications (8L)

p-n junction formation and depletion region, energy band diagram of p-n junction at equilibrium and barrier energy, built in potential at p-n junction, energy band diagram and current through p-n junction at forward and reverse bias, Static and Dynamic resistance of Diode, Transition capacitance anddiffusion capacitance, V-I characteristics and current expression of diode, temperature dependencies of V-I

characteristics of diode, p-n junction breakdown – conditions, avalanche and Zener breakdown, Concept of Junction capacitance, Zener diode and characteristics.

Diode half wave and full wave rectifiers (centre tapped and bridge) circuits and operation ($I_{DC,}$ I_{rms}, $V_{Dc,}$ $V_{rms)}$, ripple factor without filter, efficiency, PIV, TUF; Reduction of ac ripples using filter circuit (Qualitative analysis); Design of diode clipper and clamper circuit - explanation with example, application of Zener diode in regulator circuit. Numerical problems.

Module-III: Bipolar junction transistor (6L)

Concept of "Transistor", Formation of PNP/NPN Transistors, energy band diagram, current conduction mechanism, CE, CB, CC configurations, transistor static characteristics in CE, CB and CC mode, junction biasing condition for active, saturation and cut-off modes, current gain α, β and γ, early effect.
Biasing and bias stability; biasing circuits - fixed bias; voltage divider bias; collector to base bias, D.C. load line and Quiescent point, calculation of stability factors for different biasing circuits.
BJT as an amplifier and as a switch – Graphical analysis; Numerical Problems.

Module-IV: Field effect transistor (6L)

Concept of "field effect", Classification of FETs-JFET, MOSFET, operating principle of JFET. Drain and transfer characteristics of JFET (n-channel and p-channel), CS, CG, CD configurations, Relation between JFET parameters. FET as an amplifier and as a switch– graphical analysis. E-MOSFET (n-channel and p-channel), D-MOSFET (n-channel and p-channel), Numerical Problems.

Module-V: Feedback and Operational Amplifier (8L)

Concept of feedback with block diagram, positive and negative feedback, gain with feedback. Feedback topologies, effect of feedback on input and output impedance, distortion, concept of oscillation and Barkhausen criterion.
Operational amplifier – electrical equivalent circuit, ideal characteristics, non-ideal characteristics of op-amp – offset voltages; bias current; offset current; Slew rate; CMRR and bandwidth, Configuration of inverting and non-inverting amplifier using Op-amp, closed loop voltage gain of inverting and non-inverting amplifier, Concept of virtual ground, Applications op-amp – summing amplifier; differential amplifier; voltage follower; basic differentiator and integrator, Numerical Problems.

Module-VI: Cathode Ray Oscilloscope (2L)

Operating principle of CRO with block diagram, measurement of voltage, frequency and phase.

Text Books :

1.D. Chattopadhyay, P. C. Rakshit, Electronics Fundamentals and Applications, New Age International
2.Millman & Halkias, Integrated Electronics, Tata McGraw Hill.
3.Sedra & Smith, Microelectronics Engineering

Reference Books :

1.John D. Ryder, Electronic Fundamentals and Applications, PHI
2.J.B.Gupta, Basic Electronics, S.K. Kataria.
3.Malvino: Electronic Principle.
4.Boyelstad & Nashelsky: Electronic Devices & Circuit Theory, McGraw Hill, 1976.

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1	1	-	-	-	-	-	2	-	1
CO2	3	3	3	1	-	-	-	-	1	1	1	2
CO3	3	1	1	1	-	-	-	-	1	1	1	1
CO4	3	2	1	1	-	-	-	-	1	1	2	2
CO5	3	2	3	1	-	-	-	-	1	1	1	2
CO6	3	3	3	1	-	-	-	-	2	1	2	3

Course Name: English
Course Code: HU101
Contact: 2:0:0

Total Contact Hours: 24

Credits: 2

Prerequisites: The course presupposes a high school level knowledge of English grammar, punctuation, and elementary to intermediate reading and writing skills.

Course Objectives: The basic objectives of this course are to impart professional communication skills in the globalized workplace context, to enable functional competence in reading and writing so as to create industry-ready personnel.

Course Outcome(s):

CO1: Know about and employ communication in a globalized workplace scenario.
CO2: Understand and apply functional grammar, reading skills and sub-skills.
CO3: Acquire a working knowledge of writing strategies, formats and templates of professional writing.
CO4: Apply and make use of the modalities of intercultural communication.

Course Content:

Module 1: Communication in a Globalized World **4L**

1.1 Definition, Process, Types of Communication
1.2 Verbal and Non-Verbal Communication
1.3 Barriers to Communication
1.4 Workplace Communication

Module 2: Functional Grammar 4L

2.1 Articles, Prepositions and Verbs
2.2 Verb-Subject Agreement
2.3 Voice, Modality and Modifiers
2.4 Direct and Indirect Speech
2.5 Common Errors in English

Module 3: Vocabulary and Reading 6L

3.1 Word Roots, Prefixes and Suffixes
3.2 Antonyms, Synonyms and one word Substitution
3.3 Reading—Purposes and Skills (Skimming, Scanning & Intensive Reading)
3.4 Reading Comprehension (Fictional and Non-fictional prose)

Module 4: Professional Writing 10L

4.1 Writing Functions: Describing, Defining, Classifying
4.2 Structuring—coherence and clarity
4.3 Business Writing—Letters (Enquiry, Order, Sales, Complaint, Adjustment, Job Application letters), Memos, Notices, Circulars, Agendas and Minutes of Meetings).
4.4 E-mails—types, conventions, jargons and modalities.
4.5 Reports and Proposals
4.6 Précis writing
4.7 Essay writing
4.8 Punctuation and its importance in writing
4.9 Writing for an Audience.

Textbooks:

1. Ruskin Bond: The Night Train at Deoli OR Khushwant Singh: The Portrait of a Lady
2. Roald Dahl: Lamb to the Slaughter OR Somerset Maugham: The Man with the Scar
3. Anne Frank: The Diary of a Young Girl (Letters of 3rd February 1944, 12th February 1944 and13th February 1944) OR Jawaharlal Nehru: "How Britain Ruled India" (Glimpses of World History, Chap 112)

Reference Books:

1. Raymond Murphy. English Grammar in Use. 3rd Edn. CUP, 2001.
2. A. J Thomson and A. V. Martinet. A Practical English Grammar Oxford: OUP, 1980.
3. Michael Swan. Practical English Usage. Oxford: OUP, 1980.
4. Simeon Potter. Our Language. Oxford: OUP, 1950.
5. Pickett, Laster and Staples. Technical English: Writing, Reading & Speaking. 8th ed. London: Longman, 2001.
6. Ben Heasley and Liz Hamp-Lyons. Study Writing. Cambridge: CUP, 2006.

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10	P11	P12
CO1	**3**	**-**	**-**	**-**	**-**	**-**	**1**	**-**	**-**	**3**	**-**	**2**
CO2	**2**	**3**	**2**	**-**	**-**	**2**	**2**	**-**	**-**	**3**	**-**	**3**
CO3	**1**	**3**	**-**	**-**	**-**	**3**	**3**	**-**	**-**	**3**	**-**	**3**
CO4	**-**	**-**	**-**	**-**	**-**	**3**	**3**	**-**	**-**	**3**	**-**	**3**

Course Name: Physics I Lab
Course Code: PH 191
Contact: 0:0:3
Credits: 1.5

Prerequisites: Knowledge of Physics upto 12^{th} standard.

Course Outcome(s):

CO1 : Demonstrate experiments allied to their theoretical concepts
CO2 : Conduct experiments using LASER, Optical fiber, Torsional pendulum, Spctrometer
CO3 : Participate as an individual, and as a member or leader in groups in laboratory sessions actively
CO4 : Analyze experimental data from graphical representations , and to communicate effectively them in Laboratory reports including innovative experiments

List of Experiments:

General idea about Measurements and Errors (One Mandatory):

i) Error estimation using Slide calipers/ Screw-gauge/travelling microscope for one experiment.
ii) Proportional error calculation using Carrey Foster Bridge.

Any 6 to be performed from the following experiments

Experiments on Waves & Oscillations:

1. Study of Torsional oscillation of Torsional pendulum & determination of time period using various load of the oscillator.
2. Determination of elastic moduli of different materials (Young's modulus /Rigidity modulus)

Experiments on Classical Optics:

3. Determination of wavelength of light by Newton's ring method.
4. Determination of wavelength of light by Laser diffraction method.

Experiments on Quantum Physics-I:

5. Determination of Planck's constant using photoelectric cell.
6. Verification of Bohr's atomic orbital theory through Frank-Hertz experiment.
7. Determination of Stefan's Constant

Experiments on Solid State Physics-I:

8. Determination of Band gap of a semiconductor

In addition it is **recommended that each student should carry out at least one experiment beyond the syllabus/one experiment as Innovative experiment.

Probable experiments beyond the syllabus:

1. Determination of wavelength of light by Fresnel's bi-prism method (beyond the syllabus).
3. Study of dispersive power of material of a prism.
4. Study of viscosity using Poiseullie's capillary flow method/using Stoke's law.
5. Measurement of nodal and antinodal points along transmission wire and measurement of wave length.
6. Any other experiment related to the theory**.**
7. Innovative Experiments.

CO-PO Mapping:

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

Course Name: Basic Electronics Engineering Lab
Course Code: EC 191
Contact: 0:0:3
Credit: 1.5

Prerequisites: A basic course in electronics and Communication engineering Progresses from the fundamentals of electricity, active and passive components, basic electronics laws like Ohm's law, Ampere's law.

Course Objective:

The objectives of this course are

1. To prepare the students to have a basic knowledge of active and passive components.
2. To build knowledge to distinguish pure and impure DC signals.
3. To grow measuring ability of signals through multi meter and CRO
4. To understand characteristics of proper biasing for BJT and FET.
5. To encourage in developing circuits using diodes, transistors, FETs and OPAMPs.

Course Outcomes:

CO1	Knowledge of Electronic components such as Resistors, Capacitors, Diodes, Transistors measuring equipment like DC power supply, Multimeter, CRO, Signal generator, DCpower supply.
CO2	Analyse the characteristics of Junction Diode, Zener Diode, BJT & FET and different types of Rectifier Circuits.
CO3	Determination of input-offset voltage, input bias current and Slew rate, Common- mode Rejection ratio, Bandwidth and Off-set null of OPAMPs.
CO4	Able to know the application of Diode, BJT & OPAMP.

List of Experiments:

1. Familiarization with passive and active electronic components such as Resistors, Inductors, Capacitors, Diodes, Transistors (BJT) and electronic equipment like DC power supplies, millimeters etc.

2. Familiarization with measuring and testing equipment like CRO, Signal generators etc.
3. Study of I-V characteristics of Junction diodes.
4. Study of I-V characteristics of Zener diodes.
5. Study of Half and Full wave rectifiers with Regulation and Ripple factors.
6. Study of I-V characteristics of BJTs.
7. Study of I-V characteristics of Field Effect Transistors.
8. Determination of input-offset voltage, input bias current and Slew rate of OPAMPs.
9. Determination of Common-mode Rejection ratio, Bandwidth and Off-set null of OPAMPs.
10. Study of OPAMP circuits: Inverting and Non-inverting amplifiers, Adders, Integrators and Differentiators.
11. Study of Logic Gates and realization of Boolean functions using Logic Gates.
12. Study of Characteristic curves for CB, CE and CC mode transistors.
13. Innovative Experiment

Textbooks:

1.D. Chattopadhyay, P. C. Rakshit, Electronics Fundamentals and Applications, New Age International
2.Millman & Halkias, Integrated Electronics, Tata McGraw Hill.
3.Sedra & Smith, Microelectronics Engineering

Reference Books:

1.John D. Ryder, Electronic Fundamentals and Applications, PHI
2.J.B. Gupta, Basic Electronics, S.K. Kataria.
3.Malvino: Electronic Principle.
4.Boyelstad & Nashelsky: Electronic Devices & Circuit Theory, McGraw Hill, 1976.

CO-PO Mapping:

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

Course Name: Workshop/Manufacturing Practices
Course Code: ME 192
Contact: 0:0:3
Credit: 1.5

Prerequisite: Higher Secondary with Mathematics, Physics and

ChemistryCourse Objectives:

To understand the basic knowledge of Workshop Practice and Safety. To identify and use of different hand tools and other instruments like Hack Saw, Jack Plane, Chisels etc. and operations like Marking, Cutting etc. To expose students to different types of manufacturing/fabrication processes

Course Outcome(s):

CO1: Fabricate components with their own hands.
CO2: Get practical knowledge of the dimensional accuracies and tolerances applicable for different manufacturing processes.
CO3: Produce small devices of their interest for project or research purpose.

Course Content:

(i) Theoretical discussion & videos: (3P)

Detailed contents:

1. Manufacturing Methods- casting, forming, machining, joining, advanced manufacturing methods
2. Fitting operations & power tools
3. Carpentry
4. Welding (arc welding & gas welding), brazing
5. Electrical & Electronics
6. Metal casting
7. CNC machining, Additive manufacturing
8. Plastic moulding& Glass Cutting.

(ii) Workshop Practice:

Module 1 - Machine shop (6P)

Typical jobs that may be made in this practice module:

i. To make a pin from a mild steel rod in a lathe.

ii. To make rectangular and vee slot in a block of cast iron or mild steel in a shaping and / or milling machine.

Module 2 - Fitting shop (6P)

Typical jobs that may be made in this practice module:

i. To make a Gauge from MS plate.

Module 3 - Carpentry (6P)

Typical jobs that may be made in this practice module:

i. To make wooden joints and/or a pattern or like.

Module 4 - Welding shop (Arc welding 3P + gas welding 3P) (3P)

Typical jobs that may be made in this practice module:

i. ARC WELDING (3P): To join two thick (approx 5mm) MS plates by manual metal arcwelding.

ii. GAS WELDING (3P): To join two thin mild steel plates or sheets by gas welding.

Module 5 - Electrical & Electronics (3P)

House wiring, soft Soldering

Module 6 – Smithy (3P)

Typical jobs that may be made in this practice module:

i. A simple job of making a square rod from a round bar or like.

For further study (Optional)

Module 7 - Casting

Typical jobs that may be made in this practice module:

i. One/ two green sand moulds to prepare, and a casting be demonstrated.

Module 8 - Plastic moulding & Glass Cutting (3P)

Typical jobs that may be made in this practice module:

i. For plastic moulding, making at least one simple plastic component should be made.
ii. At least one sample shape on glass should be made using laser cutting machine.
Examinations could involve the actual fabrication of simple components, utilizing one or more of the techniques covered above.
iii. Innovative experiment

Text Books:

1. Hajra Choudhury S.K., Hajra Choudhury A.K. and Nirjhar Roy S.K., "Elements of WorkshopTechnology", Vol. I 2008 and Vol. II 2010, Media promoters and publishers private limited, Mumbai.
2. Rao P.N., "Manufacturing Technology", Vol. I and Vol. II, Tata McGrawHill House, 2017.

Reference Books:

1. Gowri P., Hariharan and A. Suresh Babu, Manufacturing Technology – I, Pearson Education, 2008.
2. Roy A. Lindberg, "Processes and Materials of Manufacture", 4th edition, Prentice Hall India, 1998.
3. Kalpakjian S. and Steven S. Schmid, Manufacturing Engineering and Technology, 4th edition, Pearson Education India Edition, 2002.
4. Manufacturing Science by A.Ghosh and A.K.Mallick, Wiley Eastern.
5. Principles of Metal Cutting/Principles of Machine Tools by G.C.Sen and A.Bhattacharya, New Central Book Agency, Kolkata.

CO-PO Mapping:

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

Curriculum for B.Tech 2nd Semester

Under Autonomy (**GR A:** ECE, EE, EIE, BME; **GR B:** CSE, IT, ME, CE, FT)

2nd Semester								
Sl No	**Course Type**	**Course Code**	**Theory**	**Credit Hours /Week**				**Credit Points**
				L	**T**	**P**	**Total**	
A. THEORY								
1	BS	M 201	Mathematics -II	3	1	0	4	4
2	BS	CH 201/ PH 201	Chemistry - (Gr. B) / Physics – I (Gr. A)	3	0	0	3	3
3	ES	EE 201/ ECEC 201	Basic Electrical Engineering (Gr. B) / Basic Electronics Engineering (Gr. A)	3	0	0	3	3
4	ES	CS 201	Programming for Problem Solving	3	0	0	3	3
5	ES	ME 201	Engineering Mechanics	3	0	0	3	3
Total of Theory							**16**	**16**
B. PRACTICAL								
6	ES	CS291	Programming for Problem Solving Lab	0	0	3	3	1.5
7	BS	CH 291/ PH 291	Chemistry Lab (Gr. B) / Physics - I Lab (Gr. A)	0	0	3	3	1.5
8	ES	EE 291/ EC 291	Basic Electrical Engineering Lab (Gr. B) / Basic Electronics Engineering Lab (Gr. A)	0	0	3	3	1.5
9	ES	ME 291/ ME 292	Engineering Graphics & Design (Gr B) / Workshop/Manufacturing Practice (Gr-A)	0	0	3	3	1.5
10	HS	HU 291	Language Lab	0	0	2	2	1
11	PROJ	PR 291	Project-II	0	0	1	1	0.5
12	PROJ*	PR 292	Innovative activities-I	0	0	0	0	0.5
C. MANDATORY ACTIVITIES / COURSES								
13	MC	MC 281	NSS/ Physical Activities/Meditation & Yoga/Photography/ Nature Club	0	0	0	3	
Total of Theory, Practical & Mandatory Activities/Courses							**34**	**24**

* Inter/ Intra Institutional Activities viz; Training with higher Institutions; Soft skill training organized by Training and Placement Cell of the respective institutions; contribution at incubation/ innovation /entrepreneurship cell of the institute; participation in conferences/ workshops/ competitions etc.; Learning at Departmental Lab/ Tinkering Lab/ Institutional workshop; Working in all the activities of Institute's Innovation Council for eg: IPR workshop/Leadership Talks/ Idea/ Design/ Innovation/ Business Completion/ Technical Expos etc. (evaluation by Programme Head through certification)

Innovative activities to be evaluated by the Programme Head/ Event coordinator based on the viva voce and submission of necessary certificates as evidence of activities.

Course Name: Mathematics - II
Course Code: M 201
Contact: 3:1:0

Total Contact Hours: 48

Credit: 4

Prerequisites: The students to whom this course will be offered must have the concept of (10+2) standard calculus.

Course Objectives: The objective of this course is to disseminate the prospective engineers with techniques in multivariable calculus, ordinary differential equations and Laplace transform. It aims to equip the students with concepts and tools at an intermediate to advanced level of mathematics and applications that they would find useful in their disciplines.

Course Outcome(s):

After completion of the course students are able to
CO1: Use mathematical tools to evaluate multiple integrals and vector integrals
CO2: Apply effective mathematical tools for the solutions of ordinary differential equations that model physical processes.
CO3: Recall the properties of Laplace Transform to evaluate multiple integrals and their usage
CO4: Understand the concept of Laplace transform to solve ordinary differential equations.

Course Content:

Module I: Multivariable Calculus (Integration): (12 L)

Double integration, Change of order of integration in double integrals, Triple integrals, vector line integrals, scalar surface integrals, vector surface integrals, Green's theorem, Gauss divergence theorem and Stokes' theorem.

Module II: First Order Ordinary Differential Equations: (10 L)

Solution of first order and first degree ODE: Exact ODE, Rules for finding Integrating factors, Linear ODE, Bernoulli's equation, Solution of first order and higher degree ODE: solvable for $p$solvable for y solvable for $x$and Clairaut's equation.

Module III: Second Order Ordinary Differential Equations: (12 L)

Solution of second order ODE with constant coefficients: C.F. & P.I., Method of variation of parameters, Cauchy-Euler equations, Reduction of 2^{nd} order ODE to a pair of first order ODEs, Solution of simultaneous linear ODEs.

Module IV: Laplace Transform: (14L)

Definition and existence of LT, LT of elementary functions, First and second shifting properties, Change of scale property, LT of $t f(t)$, LT of $\frac{f(t)}{t}$, LT of derivatives of f (t), LT of $\int f(t)dt$, Evaluation of improper integrals using LT, LT of periodic and step functions, Inverse LT: Definition and its properties, Convolution theorem (statement only) and its application to the evaluation of inverse LT, Solution of linear ODE with constant coefficients (initial value problem) using LT.

Textbooks:

1. Kreyszig, E., Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
2. Ramana, B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint, 2010.
3. Veerarajan, T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008.
4. Grewal, B.S., Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010.
5. Bali, N.P. and Goyal, M., A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2008.

Reference Books:

1. Thomas, G.B. and Finney, R.L., Calculus and Analytic geometry, 9th Edition, Pearson, Reprint, 2002.
2. Boyce, W. E. and DiPrima, R. C., Elementary Differential Equations and Boundary Value Problems, 9th Edn., Wiley India, 2009.
3. Ross, S. L., Differential Equations, 3rd Ed., Wiley India, 1984.
4. Piskunov, N., Differential and Integral Calculus, Vol. I & Vol. II, Mir Publishers, 1969.
5. Coddington, E. A., An Introduction to Ordinary Differential Equations, Prentice Hall, India, 1995.

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10	P11	P12
CO1	3	2	2	-	-	-	-	-	-	-	-	1
CO2	3	2	2	-	-	-	-	-	-	-	-	1
CO3	2	2	-	-	-	-	-	-	-	-	-	1
CO4	3	3	2	-	-	-	-	-	-	-	-	1

Course Name: Chemistry
Course Code: CH201
Contact: 3:0:0

Total Contact Hours: 36
Credits: 3

Prerequisites: Knowledge of Chemistry up to 12^{th} standard.

Course Objective:

The concepts developed in this course will aid in quantification of several concepts in chemistry that have been introduced at the 10+2 levels in schools. Technology is being increasingly based on the electronic, atomic and molecular level modifications.

Course Outcome(s):

CO1: Able to describe the fundamental properties of atoms & molecules, atomic structure and the periodicity of elements in the periodic table

CO2: Able to apply fundamental concepts of thermodynamics in different engineering applications.

CO3: Able to apply the knowledge of water quality parameters, corrosion control & polymers to different industries.

CO4: Able to determine the structure of organic molecules using different spectroscopic techniques.

CO5: Capable to evaluate theoretical and practical aspects relating to the transfer of the production of chemical products from laboratories to the industrial scale, in accordance with environmental considerations.

Course Contents:

Module I: Inorganic Chemistry (9 L)

(i) Atomic structure (5 L)

Bohr's theory to hydrogen-like atoms and ions; spectrum of hydrogen atom. Quantum numbers, Introduction to the concept of atomic orbitals, diagrams of s, p and d orbitals, Pauli'sexclusion principle, Hund's rule, exchange energy, Aufbau principle and its limitation, introduction to Schrodinger equation.

(ii) Periodic properties (4 L)

Modern Periodic table, group trends and periodic trends in physical properties: electronaffinity, electronegativity, polarizability, oxidation states, effective nuclear charges, penetration of orbitals, variations of s, p and d orbital energies of atoms.

Module II: Physical Chemistry (8 L)

(i) Use of free energy in chemical equilibria (6 L)

Thermodynamic functions: internal energy, enthalpy, entropy and free energy. 2nd Law of Thermodynamics, Estimations of entropy and free energies, Free energy and emf, Cell potentials, the Nernst equation and applications.

(ii) Real Gases (2 L)

Reason for deviation of real gases from ideal behavior, Equations of state of real gases, Vander Waals' equation, pressure & volume correction, validity, critical state of gas.

Module III: Organic Chemistry (8 L)

(i) Stereochemistry (4 L)

Representations of 3 dimensional structures, Chirality, optical activity, isomerism, structural isomerism, stereoisomers, enantiomers, diastereomers, configurations (D,L & cis trans), racemisation.

(ii) Organic reactions (4L)

Concepts of inductive effect, resonance, hyperconjugation, introduction to reactions involving substitution, addition, elimination, oxidation (Baeyer villiger oxidation), reduction (Clemmensen reduction, Wolff-Kishner reduction)

Module IV: Industrial Chemistry 8L

(i) **Water (2 L):** Hardness, alkalinity, numerical

(ii) **Corrosion. (2 L):** Types of corrosion: wet & dry, preventive measures

(iii) **Polymers (3 L):** Classification of polymers, conducting polymers, biodegradable polymers

(iv) **Synthesis of a commonly used drug molecule. (1 L):** Paracetamol, Aspirin

Module V: Spectroscopic techniques in Chemistry (3L)

Electromagnetic radiation, Principles of spectroscopy, spectrophotometer, infrared spectroscopy, fingerprint region, functional group region, UV-VIS spectroscopy, ^{1}H Nuclear magnetic resonance spectroscopy, chemical shift

Textbooks

(i) A Text Book of Organic Chemistry, Arun Bahl & Arun Bahl
(ii) General & Inorganic Chemistry, P.K. Dutt
(iii) General & Inorganic Chemistry, Vol I, R.P. Sarkar
(iv) Physical Chemistry, P.C. Rakshit

Reference Books

(v) Chemistry: Principles and Applications, by M. J. Sienko and R. A. Plane (iii)Fundamentals of Molecular Spectroscopy, by C. N. Banwell
(iv) Engineering Chemistry (NPTEL Web-book), by B. L. Tembe, Kamaluddin and M. S. Krishnan
(v) Physical Chemistry, by P. W. Atkins
(vi) Organic Chemistry: Structure and Function by K. P. C. Volhardt and N. E. Schore, 5th Edition http://bcs.whfreeman.com/vollhardtschore5e/default.asp

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	2	-	-	-	-	1	2	2	2
CO2	3	3	3	3	-	-	-	-	1	1	2	3
CO3	3	3	2	1	-	2	1	-	1	-	3	3
CO4	3	2	3	2	-	-	1	-	1	2	3	3
CO5	3	3	3	3	1	1	1	-	1	-	2	3

Course Name: Basic Electrical Engineering
Course Code: EE201
Contact: 3:0:0
Total Contact hours: 36
Credits: 3

Prerequisites:

- Basic 12^{th} standard Physics and Mathematics.
- Concept of components of electric circuit.

Course Objective:

To introduce the students to basic principles of DC and AC circuits, Electrical Machines and Electrical Systems.

Course Outcome(s):

CO1: To understand Basic Electrical circuits, Power distribution and Safety measures.
CO2: To analyze an apply DC network theorems.
CO3: To analyze and apply concept of AC circuits of single-phase and three-phase.
CO4: To analyze and apply concepts of AC fundamentals in solving AC network problems.
CO5: To understand basic principles of Transformers and Rotating Machines.

Course contents:

Module I: DC Circuits (9L)

Definition of electric circuit, linear circuit, non-linear circuit, bilateral circuit, unilateral circuit, Dependent source, node, branch, active and passive elements, Kirchhoff's laws, Source equivalence and conversion, Network Theorems - Superposition Theorem, Thevenin's Theorem, Norton Theorem, Maximum Power Transfer Theorem, Star-Delta Conversions.

Module II: AC Fundamentals (9L)

Sinusoidal quantities, Average and RMS values, peak factor, Form factor, Phase and Phase difference, concept of phasor diagram, V-I Relationship in R, L, C circuit, Combination R-L-C in series and parallel circuits with phasor diagrams, impedance and admittance, impedance triangle and powertriangle, Power factor, concept of resonance, Power in AC circuit, simple problems (series and parallel circuit only), Three-phase balanced circuits, Concept of three-phase power measurement.

Module III: Single-Phase Transformer (5L)

Brief idea on constructional parts, classifications, working principle. Problems on EMF equation. Phasor diagram, Equivalent circuit.

Module IV:Electrical Rotating Machines (8L)

a)DC Machines (4L)

Brief idea on constructional features, classifications, working principle of both motor and generator. Simple problems on Voltage equation.

b) Three-Phase Induction Motor (4L)

Basic concept of three phase circuit and production of rotating magnetic field. Working principle of three-phase induction motor and torque-speed characteristics (concept only). No numerical problem.

Module V:General Structure of Electrical Power System (1L)

Power generation to distribution through overhead lines and underground cables with single line diagram.

Module VI:Electrical Installations (4L)

Earthing of Electrical Equipment, ideas of basic components- MCB, MCCB, ELCB, SFU, Megger.

Text books:

1. D. P. Kothari & I. J. Nagrath, Basic Electrical Engineering, TMH.
2. V. Mittle & Arvind Mittal, Basic Electrical Engineering, TMH.
3. Ashfaq Hussain, Basic Electrical Engineering, S. Chand Publication.
4. Chakrabarti,Nath & Chanda, Basic Electrical Engineering, TMH.
5. C.L. Wadhwa, Basic Electrical Engineering, Pearson Education.

Reference books:

1. E. Hughes, "Electrical and Electronics Technology", Pearson, 2010.
2. V. D. Toro, "Electrical Engineering Fundamentals", Printice Hall India, 1989.

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10	P11	P12
CO1	3	1	-	-	-	2	-	-	-	2	2	1
CO2	2	3	-	-	-	-	-	-	-	-	1	1
CO3	2	3	1	-	-	-	-	-	-	-	1	1
CO4	1	2	3	1	-	-	-	-	-	-	-	1
CO5	3	-	-	-	-		-	-	-	-	-	1

Course Name: Programming for Problem Solving
Course Code: CS 201
Contact: 3:0:0
Total Contact Hours: 36
Credits: 3

Prerequisites: Number system, Boolean Algebra

Course Outcomes:

CO1	Understand and differentiate among different programming languages for problem solving.
CO2	Describe the way of execution and debug programs in C language.
CO3	Define, select, and compare data types, loops, functions to solve mathematical and scientific problem.
CO4	Understand the dynamic behavior of memory by the use of pointers.
CO5	Design and develop modular programs using control structure, selection structure and file.

Course Content:

Fundamentals of Computer: (8 L)

History of Computer, Generation of Computer, Classification of Computers, Basic structure of Computer System, Primary & Secondary Memory, Processing Unit, Input & Output devices. 2L

Binary and Allied number systems representation of signed & unsigned numbers, BCD, ASCII, Binary number. Arithmetic – Addition and Subtraction (using 1's complement and 2's complement). 2L

Overview of Procedural vs Structural language, compiler and assembler (basic concepts) 1L

Problem solving- Algorithm & flow chart. 2L

C Fundamentals: (28 L)

Variable and Data Types: The C character set identifiers and keywords, data type & sizes, variable names, declaration, statements. 2L

C Operators & Expressions:

Arithmetic operators, relational operators, logical operators, increment and decrement operators, bitwise operators, assignment operators, conditional operators, special operators - type conversion, C expressions, precedence and associativity.
Input and Output: Standard input and output, formatted output - printf, formatted input scanf, bit fields. 4L

Branching and Loop Statements:

Statement and blocks, if - else, switch, goto and labels, Loops - while, for, do while, break and continue.

4L

Fundamentals and Program Structures:

auto, external, static and register variables Functions, function types, function prototypes, functions returning values, functions not returning values, scope rules, recursion, C preprocessor and macro.

5L

Arrays, Strings and Pointers:

One dimensional arrays, Two-dimensional arrays, Multidimensional arrays. Passing an array to afunction Character array and string, array of strings, Passing a string to a function, String related functions, Pointers, Pointer and Array, Pointer and String, Pointer and functions, Dynamic memory allocation. 7L

Structures and Unions:

Basic of structures, arrays of structures, structures and pointers, structures and functions. 3L

Files handling with C:

formatted and unformatted files, Command line arguments, fopen, fclose, fgetc, fputc, fprintf, fscanf function. 3L

Textbook:

Kerninghan B.W. & Ritchie D.M. - The C Programming Language ,PHI, 2nd Edition
Kanetkar Y. - Let us C, BPB Publication, 15th Edition

Reference Books:

E Balagurusamy – Programming in ANSI C, TMH, 3rd Edition
K R Venugopal & S R Prasad – MASTERING C, TMH, 2nd Edition
Reema Thareja – INTRODUCTION TO C PROGRAMMING, OXFORD UNIVERSITY PRESS, 2nd Edition

CO – PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1	1	-	-	1	-	3	3	1	1
CO2	2	2	3	3	2	2	-	-	3	3	3	3
CO3	2	2	2	2	2	1	-	-	3	3	1	3
CO4	3	2	2	2	2	3	-	-	3	3	2	3
CO5	3	3	3	3	2	3	-	-	3	3	3	3

Course Name: Engineering Mechanics
Course Code: ME 201
Contacts: 3:0:0
Total Contact Hours: 36
Credits: 3

Prerequisites: Basic Concept of Physics

Course Objective:

This course teaches students how to apply Newtonian physics to relatively simple real life applications. This course covers statics, dynamics and elementary part of strength of materials.

Course Outcome(s):

CO1: To understand representation of force, moments for drawing free-body diagrams and analyze friction based systems in static condition
CO2: To locate the centroid of an area and calculate the moment of inertia of a section.
CO3: Apply of conservation of momentum & energy principle for particle dynamics and rigid body kinetics
CO4: Understand and apply the concept of virtual work, rigid body dynamics and systems under vibration.

Course Contents:

Module 1: Introduction to Engineering Mechanics: Force Systems Basic concepts, Particle equilibrium in 2-D & 3-D; Rigid Body equilibrium; System of Forces, Coplanar Concurrent Forces, Components in Space – Resultant- Moment of Forces and its Application; Couples and Resultant of Force System, Equilibrium of System of Forces, Free body diagrams, Equations of Equilibrium of Coplanar Systems and Spatial Systems; Static Indeterminacy. 6L

Module 2: Friction: Types of friction, Limiting friction, Laws of Friction, Static and Dynamic Friction; Motion of Bodies, wedge friction, screw jack & differential screw jack. 2L

Module 3: Basic Structural Analysis: Equilibrium in three dimensions; Method of Sections; Method of Joints; How to determine if a member is in tension or compression; Simple Trusses; Zero force members; Beams & types of beams; Frames & Machines. 3L

Module 4: Centroid and Centre of Gravity: Centroid of simple figures from first principle, centroid of composite sections; Centre of Gravity and its implications; Area moment of inertia- Definition, Moment of inertia of plane sections from first principles, Theorems of moment of inertia, Moment of inertia of standard sections and composite sections; Mass moment inertia of circular plate, Cylinder, Cone, Sphere, Hook. 5L

Module 5: Virtual Work and Energy Method: Virtual displacements, principle of virtual work for particle and ideal system of rigid bodies, degrees of freedom. Active force diagram, systems with friction, mechanical efficiency. Conservative forces and potential energy (elastic and gravitational), energy equation for equilibrium. Applications of energy method for equilibrium. Stability of equilibrium. 5L

Module 6: Review of particle dynamics: Rectilinear motion; Plane curvilinear motion (rectangular, path, and polar coordinates). 3-D curvilinear motion; Relative and constrained motion; Newton's 2nd law (rectangular, path, and polar coordinates). Work-kinetic energy, power, potential energy.Impulse-momentum (linear, angular); Impact (Direct and oblique).5L

Module 7: Introduction to Kinetics of Rigid Bodies: Basic terms, general principles in dynamics; Types of motion, Instantaneous centre of rotation in plane motion and simple problems; D'Alembert's principle and its applications in plane motion and connected bodies; Work energy principle and its application in plane motion of connected bodies; Kinetics of rigid body rotation. 5L

Module8: Mechanical Vibrations: Basic terminology, free and forced vibrations, resonance and its effects; Degree of freedom; Derivation for frequency and amplitude of free vibrations without damping and single degree of freedom system, simple problems, types of pendulum, use of simple, compound and torsion pendulums. 5L

Textbooks:

1. Irving H. Shames (2006), Engineering Mechanics, 4th Edition, Prentice Hall
2. F. P. Beer and E. R. Johnston (2011), Vector Mechanics for Engineers, Vol I - Statics, Vol II, – Dynamics, 9th Ed, Tata McGraw Hill
3. R.C. Hibbler (2006), Engineering Mechanics: Principles of Statics and Dynamics, Pearson Press.
4. Andy Ruina and Rudra Pratap (2011), Introduction to Statics and Dynamics, Oxford University Press
5. Shanes and Rao (2006), Engineering Mechanics, Pearson Education,
6. Hibler and Gupta (2010),Engineering Mechanics (Statics, Dynamics) by Pearson Education

Reference books:

1. Reddy Vijaykumar K. and K. Suresh Kumar(2010), Singer's Engineering Mechanics
2. Bansal R.K.(2010), A Text Book of Engineering Mechanics, Laxmi Publications
3. Khurmi R.S. (2010), Engineering Mechanics, S. Chand & Co.
4. Tayal A.K. (2010), Engineering Mechanics, Umesh Publications

CO – PO Mapping:

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

Course Name: Programming for Problem Solving Lab
Course Code: CS291
Contacts: 0:0:3
Credits: 1.5

Prerequisites: Number system, Boolean Algebra.

Course Outcomes:

At the end of the course students are able to understand
CO1: Learn the concept of DOS system commands and editor.
CO2: To formulate the algorithms for simple problems and to translate given algorithms to a working and correct program.
CO3: To be able to identify and correct syntax errors / logical errors as reported during compilation time and run time.
CO4: To be able to write iterative as well as recursive programs.
CO5: Learn the concept of programs with Arrays, Pointers, Structures, Union and Files.

List of Experiment:

- Some basic commands of DOS, Windows and Linux Operating System, File handling and Directory structures, file permissions, creating and editing simple C program, compilation and execution of C program.
- Writing C Programs on variable, expression, operator and type-casting.
- Writing C Programs using different structures of if-else statement and switch-case statement.
- Writing C Programs demonstrating use of loop (for loop, while loop and do-while loop) concept and use of break and continue statement.
- Writing C Programs demonstrating concept of Single & Multidimensional arrays.
- Writing C Programs demonstrating concept of Function and Recursion.
- Writing C Programs demonstrating concept of Pointers, address of operator, declaring pointers and operations on pointers.
- Writing C Programs demonstrating concept of structures, union and pointer to structure.
- Writing C Programs demonstrating concept of String and command line arguments.
- Writing C Programs demonstrating concept of dynamic memory allocation.
- Writing C Programs demonstrating concept of File Programming.

- Innovative Experiments

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	-	-	-	2	2	-	1	-	1	2	3
CO2	3	3	3	-	-	-	-	-	-	-	-	2
CO3	2	2	2	2	2	-	-	-	-	-	-	3
CO4	1	2	2	2	2	-	-	-	-	-	-	2
CO5	2	3	3	3	2	2	3	1	3	3	3	3

Course Name: Chemistry Lab
Course Code: CH 291
Contact: 0:0:3
Credits: 1.5

Prerequisites: Knowledge of Physics up to 12th standard.

Course Objective:

- Study the basic principles of pH meter and conductivity meter for different applications.
- Analysis of water for its various parameters & its significance in industries.
- Learn to synthesis Polymeric materials and drugs.
- Study the various reactions in homogeneous and heterogeneous medium.

Course Outcome(s):

CO1: Able to operate different types of instruments for estimation of small quantities chemicals used in industries and scientific and technical fields.

CO2: Able to analyse and determine the composition of liquid and solid samples working as an individual and also as an team member

CO3: Able to analyse different parameters of water considering environmental issues.

CO4: Able to synthesize drug and polymer materials.

CO5: Capable to design innovative experiments applying the fundamentals of chemistry.

List of Experiment:

Choice of 10-12 experiments from the following:

- Determination of surface tension and viscosity
- Thin layer chromatography
- Determination of hardness of water
- Determination of chloride content of water
- Determination of the rate constant of a reaction
- Determination of cell constant and conductometric tritration
- pH metric titrations
- Synthesis of a polymer/drug
- Saponification/acid value of an oil

- Chemical analysis of a salt
- Chemical oscillations- Iodine clock reaction
- Determination of the partition coefficient of a substance between two immiscible liquids
- Adsorption of acetic acid by charcoal

Innovative experiments (any one)

- Synthesis of silver nano particles
- Green synthesis

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	3	1	-	2	3	-	-	-	-	1
CO2	2	2	1	1	-	1	-	-	-	1	-	1
CO3	-	-	-	-	-	-	-	-	3	3	2	2
CO4	2	1	2	2	-	-	1	-	-	-	-	2
CO5	3	3	3	3	1	1	1	1	-	-	2	2

Course Name: Basic Electrical Engineering Laboratory
Course Code: EE291
Contact: 0:0:3
Credits: 1.5

Prerequisites:

- Basic Physics and applied physics.
- Basic Mathematics.
- Basic concept of Electric Circuit

Course Objective:

To impart and apply knowledge about the Basic Electrical Components, Machineries, Instruments and Safety measures.

Course Outcome(s):

CO1: Identify and use common electrical components.

CO2: To develop electrical networks by physical connection of various components and analyze the circuit behavior.

CO3: Apply and analyze the basic characteristics of transformers and electrical machines.

List of Experiment:

1. Basic safety precautions – earthing, introduction to measuring instruments – Voltmeter, Ammeter, Multimeter, Wattmeter, Real life Resistor, Capacitor, Inductor.
2. Verification of Thevenin's and Norton's Theorem.
3. Verification of Superposition and Maximum Power Transfer Theorem.
4. Characteristics of Fluorescent, Tungsten and Carbon filament lamps.
5. Study of R-L-C series circuit.
6. Three-phase Power measurement with two wattmeter method.

7. Demonstration of cut-out sections of machines: DC Machine (commutator-brush arrangement), Induction Machine (squirrel cage rotor).
8. Measurement of primary and secondary voltage and current of single-phase transformer – Open Circuit and Short Circuit Test.
9. Starting, Reversing and speed control of DC shunt motor.
10. Torque-Speed characteristics of DC Machine.
11. Torque-Speed characteristics of Three-phase Induction Motor.
12. Test on single-phase Energy Meter.
13. Innovative experiments.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10	P11	P12
CO1	3	-	-	-	-	2	-	-	-	-	-	1
CO2	2	3	-	-	-	-	-	-	-	-	1	1
CO3	3	-	-	-	-	-	-	-	-	-	-	1

Course Name: Engineering Graphics & Design
Course Code: ME 291
Contact: 0:0:3
Credits: 1.5

Prerequisites: Basic knowledge of geometry

Course Objectives:

To learn detailed drawing and modeling of a system, component, or process which meets desired needs within realistic constraints. It will help students to use the techniques, skills, and modern engineering tools and communicate effectively.

Course Outcome(s):

CO1: Get introduced with Engineering Graphics and visual aspects of design.
CO2: Know and use common drafting tools with the knowledge of drafting standards.
CO3: Apply computer aided drafting techniques to represent line, surface or solid models in different Engineering viewpoints.
CO4: Produce part models; carry out assembly operation and show working procedure of a designed project work using animation.

List of Drawing:

Traditional Engineering Graphics:

Principles of Engineering Graphics; Orthographic Projection; Descriptive Geometry; Drawing Principles; Isometric Projection; Surface Development; Perspective; Reading a Drawing; Sectional Views; Dimensioning & Tolerances; True Length, Angle; intersection, Shortest Distance.

Module 1: Introduction to Engineering Drawing

Principles of Engineering Graphics and their significance, Usage of Drawing instruments, lettering, Conic sections including Rectangular Hyperbola (General method only); Cycloid, Epicycloid and Involute; Scales – Plain, Diagonal and Vernier Scales.

Module 2: Orthographic & Isometric Projections

Principles of Orthographic Projections-Conventions - Projections of Points and lines inclined to both planes; Projections of planes inclined Planes - Auxiliary Planes; Projection of Solids inclined to boththe Planes- Auxiliary Views; Isometric Scale, Isometric Views of lines, Planes, Simple and compound Solids; Conversion of Isometric Views to Orthographic Views and Vice-versa.

Module 3: Sections and Sectional Views of Right Angular Solids

Drawing sectional views of solids for Prism, Cylinder, Pyramid, Cone and project the true shape of the sectioned surface, Auxiliary Views; Development of surfaces of Right Regular Solids - Prism, Pyramid, Cylinder and Cone; Draw sectional orthographic views of objects from industry and dwellings (foundation to slab only)

Computer Graphics:

Engineering Graphics Software; -Spatial Transformations; Orthographic Projections; Model Viewing; Co-ordinate Systems; Multi-view Projection; Exploded Assembly; Model Viewing; Animation; Spatial Manipulation; Surface Modeling; Solid Modeling.

Module 4: Overview of Computer Graphics

Demonstration of CAD software [The Menu System, Toolbars (Standard, Properties, Draw, Modify and Dimension), Drawing Area (Background, Crosshairs, Coordinate System), Dialog boxes and windows, Shortcut menus (Button Bars), Zooming methods, Select and erase objects].

Module 5: CAD Drawing, Customization, Annotations, layering

Set up of drawing page including scale settings, ISO and ANSI standards for dimensioning and tolerancing; Using various methods to draw straight lines, circles, applying dimensions and annotations to drawings; Setting up and use of Layers, Changing line lengths (extend/lengthen); Printing documents; Drawing sectional views of solids and project the true shape of the sectioned surface; Drawing annotation, CAD modeling of parts and assemblies with animation, Parametric and nonparametric solid, surface and wireframe modeling, Part editing and two dimensional documentation of models.

Module 6:

Demonstration of a simple team design project

Illustrating Geometry and topology of engineered components: creation of engineering models and their presentation in standard 2D blueprint form and as 3D wire-frame and shaded solids; Meshed topologies for engineering analysis and tool-path generation for component manufacture, Use of solid-modeling software for creating associative models at the component and assembly levels.

Module 7:

Innovative experiments

Textbooks:

1. Bhatt N.D., Panchal V.M. & Ingle P.R., (2014), Engineering Drawing, Charotar Publishing House
2. (Corresponding set of) CAD Software Theory and User Manuals

Reference Books:

1. K. Venugopal**,** Engineering Drawing + AutoCAD, New Age International publishers
2. Agrawal B. & Agrawal C. M. (2012), Engineering Graphics, TMH Publication.
3. Shah, M.B. & Rana B.C. (2008), Engineering Drawing and Computer Graphics, Pearson Education
4. Narayana, K.L. & P Kannaiah (2008), Text book on Engineering Drawing, Scitech Publishers.

CO-PO Mapping:

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

Course Name: Lang. Lab. and Seminar Presentation
Course Code: HU 291
Contact: 0:0:2
Credit: 1

Prerequisites: Basic knowledge of LSRW skills.

Course Objective: To train the students in acquiring interpersonal communication skills by focussing on language skill acquisition techniques and error feedback.

Course Outcome(s):

CO1: Able to understand advanced skills of Technical Communication in English through Language Laboratory.
CO2: Able to apply listening, speaking, reading and writing skills in societal and professional life.
CO3: Able to demonstrate the skills necessary to be a competent Interpersonal communicator.
CO4: Able to analyze communication behaviours.
CO5: Able to adapt to multifarious socio-economical and professional arenas with the help of effective communication and interpersonal skills.

Course Contents:

Module 1: Introduction to the Language Lab

a. The Need for a Language Laboratory
b. Tasks in the Lab
c. Writing a Laboratory Note Book

Module 2: Active Listening

a. What is Active Listening?
b. Listening Sub-Skills—Predicting, Clarifying, Inferencing, Evaluating, Note-taking
c. Academic Listening vs Business Listening
d. Listening in Business Telephony
e. Study of Contextualized Examples based on Lab Recordings

Module 3: Speaking

a. Speaking—Accuracy and Fluency Parameters

b. Pronunciation Guide—Basics of Sound Scripting, Stress and Intonation
c. Fluency-focussed activities—JAM, Conversational Role Plays, Speaking using Picture/Audio Visual inputs
d. Accuracy-focussed activities—Identifying Minimal Pairs, Sound Mazes, Open and Closed Pair Drilling, Student Recordings (using software)
e. Group Discussion: Principles and Practice

Module 4: Lab Project Work

a. Making a brief Animation film with voice over (5 minutes)OR
b. Making a brief Documentary film (10 minutes)

Reference Books:

1. IT Mumbai**, Preparatory Course in English** syllabus
2. IIT Mumbai, **Introduction to Linguistics** syllabus
3. Sasikumar et al. *A Course in Listening and Speaking*. New Delhi: Foundation Books, 2005.
4. Tony Lynch, *Study Listening*. Cambridge: Cambridge UP, 2004.

CO – PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10	P11	P12
CO1	2	-	-	3	-	**3**	**2**	**2**	**3**	**3**	-	**3**
CO2	2	3	3	3	-	**3**	**3**	**3**	**2**	**3**	-	3
CO3	1	3	3	3	-	**2**	**2**	**2**	**2**	**3**	-	2
CO4	1	2	3	3	-	**2**	**1**	**1**	**2**	**3**	-	2
CO5	3	3	2	3	-	**2**	**3**	**2**	**2**	**3**	-	2

Course Name: NSS/Physical Activities/ Meditation & Yoga/ Photography/Nature Club
Course Code: MC 281
Contact: 0:0:3

Course Objectives:

- To increase student awareness about the weaker and unprivileged sections of society
- To expose students to environmental issues and ecological concerns
- To make students self aware about their participatory role in sustaining society and the environment

List of Activities:

a) Creating awareness in social issues
b) Participating in mass education programmes
c) Proposal for local slum area development
d) Waste disposal
e) Environmental awareness ``
f) Production Oriented Programmes
g) Relief & Rehabilitation work during Natural calamities
Creating awareness in social issues:

1. Women's development – includes health, income-generation, rights awareness.
2. Hospital activities – Eg. writing letters for patients, guiding visitors
3. Old age home – visiting the aging in-mates, arranging for their entertainment.
4. Children's Homes - visiting the young in-mates, arranging for their entertainment
5. Linking with NGOs to work on other social issues. (Eg. Children of sex-workers)
6. Gender issues- Developing an awareness, to link it with Women's Cell of college

Participating in mass education programmes: 1.Adult education 2. Children's education

Proposal for local slum area development : One or two slums to be identified and according to the needs, activities to be developed and proposals and reports are to be submitted.

Environmental awareness

- Resource conservation – Awareness to be developed on water, energy,soil.
- Preservation of heritage monuments- Marches, poster campaigns
- Alternative energy consciousness amongst younger school-children.
- Plantation and beautification- Plantation of trees, their preservation and upkeep, developing NSS parks.
- Waste disposal- Proper methods of domestic waste disposal.

Production Oriented Programmes

5. Working with people and explaining and teaching improved agricultural practices
6. Rodent control land pest control practices;
7. Soil-testing, soil health care and soil conservation;
8. Assistance in repair of agriculture machinery;
9. Work for the promotion and strengthening of cooperative societies in villages;
10. Assistance and guidance in poultry farming, animal husbandry, care of animal health etc.;
11. Popularization of small savings and
12. Assistance in procuring bank loans

Relief & Rehabilitation work during Natural calamities

g) Assisting the authorities in distribution of rations, medicine, clothes etc.;
h) Assisting the health authorities in inoculation and immunization, supply of medicine etc.;
i) Working with the local people in reconstruction of their huts, cleaning of wells, building roads etc.;
j) Assisting and working with local authorities in relief and rescue operation; Collection of clothes and other materials, and sending the same to the affected areas;

3rd Semester								
SL No	Type	Code	THEORY	Contact Hours/Week				Credits Points
				L	T	P	Total	
A. THEORY								
1	BS	M(CSE)301	Mathematics-III	3	1	0	4	4
2	BS	PH301	Physics-II	3	0	0	3	3
3	PC	CS301	Digital Electronics and Computer Organization	3	0	0	3	3
4	PC	CS302	Data Structures	3	0	0	3	3
5	ES	CS 303	Circuit Theory and Network	2	0	0	2	2
Total of Theory							15	15
B. PRACTICAL								
6	BS	PH391	Physics-II Lab	0	0	3	3	1.5
7	PC	CS391	Digital Electronics and Computer Organization Lab	0	0	3	3	1.5
8	PC	CS392	Data Structures Lab	0	0	3	3	1.5
9	PC	CS393	Programming with C++	1	0	2	3	1.5
10	PROJ	PR 391	Project-III	0	0	2	2	1
11	PROJ*	PR 392	Innovative activities-II	0	0	0	1	0.5
C. MANDATORY ACTIVITIES / COURSES								
12	MC	MC 381	Behavioural and Interpersonal Skills	0	0	3	3	
Total of Theory, Practical & Mandatory Activities/Courses							33	22.5

*Students may choose either to work on participation in all the activities of Institute's Innovation Council for eg: IPR workshop/ Leadership Talks/ Idea/ Design/ Innovation/ Business Completion/ Technical Expos etc.

Innovative activities to be evaluated by the Programme Head/ Event coordinator based on the viva voce and submission of necessary certificates as evidence of activities.

Course Name: Mathematics - III
Course Code: M(CSE) 301
Contact: 3:1:0
Total Contact Hours: 48
Credits: 4

Prerequisites:

The students to whom this course will be offered must have the concept of (10+2) standard set theory, calculus, basic probability.

Course Outcome(s):

On successful completion of the learning sessions of the course, the learner will be able to:
CO1: Recall the distinctive characteristics of probability distribution, algebraic structure, number theory, recurrence relation, propositional logic and graph theory.
CO2: Demonstrate the theoretical working of probability distribution, algebraic structure, number theory, recurrence relation, propositional logic and graph theory.
CO3: Compute the probability of real world uncertain phenomena by indentifying probability distribution that fits the phenomena.
CO4: Formulate different counting problems and solve the recurrence relation using underlying concept.
CO5: Construct the shortest path and minimal spanning tree from a given graph using the algorithms of graph theory.

Course Content:

MODULE I: ***Probability Distributions: (10 Lectures)***

Random Variable: Discrete and Continuous (definition & examples); Probability Distribution (definition & examples); Probability Mass Function, Probability Density Function and Distribution Function for a single random variable only (definition, properties & related problems); Expectation, Variance and Standard Deviation for a single random variable only (definition, properties & related problems); Binomial Distribution, Poisson Distribution, Binomial Approximation to Poisson Distribution and Normal Distribution (problems only), Mean, Variance and Standard Deviation of Binomial, Poisson and Normal Distribution (problems only).

Module II: ***Propositional Logic: (6 Lectures)***

Introduction to Propositional Calculus**,** Propositions, Logical Connectives, Conjunction, Disjunction, Negation and their truth table. Conditional Connectives, Implication, Converse, Contrapositive, Inverse, Bi-conditional statements with truth table, Logical Equivalence, Tautology, Normal forms-CNF, DNF.

Module III: ***Number Theory: (8 Lectures)***

Well Ordering Principle, Divisibility theorem (without proof) and properties of divisibility;
Fundamental theorem of Arithmetic; Euclidean Algorithm for finding G.C.D and some basic properties of G.C.D with simple examples.

Module IV: ***Recurrence Relation: (6 Lectures)***

Recurrence relations: Formulation of different counting problems in terms of recurrence relations, Solution of recurrence relations with constant coefficients by (i) The iterative method (ii) Characteristic roots method (iii) Generating functions method.

Module V: ***Algebraic Structures: (8 Lectures)***

Group (definition), Lagrange's theorem, Subgroup, Normal subgroup, Cyclic group, Permutation group, Symmetric group (S3), Definition of Ring and Field.

Module VI: ***Graph Theory: (10 Lectures)***

Graph theory, important theorems and problems, digraphs, weighted graph, connected and disconnected graph, Bipartite graph, complement of a graph, regular graph, complete graph, walk, path,circuit, Euler graph, cut set, cut vertices, adjacency and incidence matrices of a graph(digraph),Isomorphism,
Tree, Important theorems: Binary Tree, Spanning Tree, minimal spanning tree, Dijkstra's algorithm, Kruskal's Algorithm, Prim's Algorithm.

Project Domains:

1. Study of physical processes through Graph theory.
2. Application of Propositional Logic in real world engineering problems.
3. Study of uncertainty in real world phenomena using probability distribution.
4. Application of Abstract Algebra in engineering problems.

Textbooks:

1. Das, N.G. *Probability and Statistics*; The McGraw Hill Companies.
2. Gupta, S. C. and Kapoor, V. K. *Fundamentals of Mathematical Statistics*, Sultan Chand & Sons.
3. Deo, N. *Graph Theory with Applications to Engineering and Computer Science*, Prentice Hall.
4. Mapa, S. K. *Higher algebra: Abstract and Linear*, Levant, 2011.
5. Chakraborty, S. K. and Sarkar, B. K. *Discrete Mathematics*, OXFORD University Press.

Reference Books:

1. Lipschutz, S. *Theory and Problems of Probability (Schaum's Outline Series)*, McGraw Hill Book. Co.
2. Spiegel, M. R. *Theory and Problems of Probability and Statistics (Schaum's Outline Series)*, McGraw Hill Book Co.
3. Grewal, B. S. *Higher Engineering Mathematics*, Khanna Pub.
4. Kreyzig, E. *Advanced Engineering Mathematics*, John Wiley and Sons.
5. Sharma, J.K. *Discrete Mathematics*, Macmillan.
6. Spiegel, M. R., Schiller, J.J. and Srinivasan, R.A. *Probability and Statistics* (Schaum's Outline Series), TMH.

CO-PO Mapping:

CO	**PO 1**	**PO 2**	**PO3**	**PO 4**	**PO 5**	**PO6**	**PO7**	**PO8**	**PO 9**	**P1 0**	**P1 1**	**P1 2**
CO1	3	1	1	-	-	-	-	-	-	-	-	1
CO2	3	2	1	-	-	-	-	-	-	-	-	1
CO3	3	2	2	-	-	-	-	-	-	-	-	1
CO4	3	2	2	-	-	-	-	-	-	-	-	1
CO5	3	2	2	-	-	-	-	-	-	-	-	1

Course Name: Physics-II
Course Code: PH 301
Contact: 3:0:0
Total Contact Hours: 36
Credits: 3

Prerequisites:

Basic knowledge of Physics I

Course Outcome(s):

After completion of this course student will be able to
CO1: explain electromagnetic wave propagation using fundamentals of electrostatics, magnetostatics and electromagnetic theory.
CO2: apply Schrödinger equation in variety of atomic scale problems including nanomaterials.
CO3: analyze the importance of superposition principle of quantum mechanics in conceptualization of Quantum bits.
CO4: justify the importance of Fermi energy level in turning electronic properties of various semiconductors

Course Contents:

Module 1: Quantum Mechanics-II, Quantum Computation and Communication (12L)
1.01: Quantum Mechanics-II

Formulation of quantum mechanics and Basic postulates; Operator correspondence-Measurements in Quantum Mechanics- Eigen value, Eigen function, superposition principle, orthogonality of wave function, expectation value. Commutator. 3L
Time dependent Schrödinger's equation, formulation of time independent Schrödinger's equation by method of separation of variables, Schrödinger's equation as energy eigen value equation, Application of Schrödinger equation – Particle in an infinite square well potential (1-D and 3-D potential well; Discussion on degenerate levels), 1D finite barrier problem and concept of quantum tunnelling (solve only $E<V_0$). 4L

1.02: Quantum Computation and Communication

The idea of n- dimensional vector space, use of 'bra-ket' notation, matrix representation of bra &kets; basis, Hilbert space; Pauli matrices. 2L
Idea of qubit and examples of single qubit logic gates- Classical bits, qubit as a two level system; Bloch vector, Pauli gate, Hadamard gate, Phase shift gate, Quantum circuits related to Quantum gates. 3L

Module 2: Statistical Mechanics (6L) Module

2.01: Basics of Statistical Mechanics:

Concept of energy levels and energy states. Microstates, macrostates and thermodynamic probability, MB, BE, FD, statistics (Qualitative discussions)- physical significance, conception of bosons, fermions, classical limits of quantum statistics, Fermi distribution at zero & non-zero temperature, Concept of Fermi level. 4L

Module 2.02: Applications of Statistical Mechanics:

Qualitative study: Fermi level in metals, total energy at absolute zero and total number of particles.Fermi level for intrinsic and extrinsic semiconductors (pictorial representations on temperaturedependence and doping concentration viz. p type, n-type). 2L

Module 3: Storage and display devices (3L)

3.01: Different storage and display devices-Magnetic storage materials, Hard disc (examples related to

computers compared with semiconductor storage viz. Pendrive), Operation and application of CRT, Liquid crystal display (LCD), LED, Plasma display, Thin film transistor display).3L

Module 4 : Concept of Polarisation (4L)

4.01 : Definition, Plane of polarization, Plane of vibration, Malus Law, Fundamental concepts of plane, circular & elliptical polarizations (only qualitative idea) with examples, Brewster's law, Double refraction : Ordinary & Extra ordinary rays, Nicol's prism, Engineering applications in E.M.Theory, Numerical problems 3L

Module 5: Electricity and Magnetism (8L)

Module 5.01:Electrostatics

Gauss's law in integral form and conversion into differential form, Equation of continuity, Extend to Poisson's & Laplace's equation, Application to parallel plate, spherical and cylindrical capacitors. 3L

Module 5.02: Magnetostatics:

Lorentz force (concept in Hall effect-), force on a small current element placed in a magnetic field. Biot-Savart law- non existence of magnetic monopole, Ampere's circuital law, Magnetic vector and scalar potential. 3L

Module 5.03: Electro-magnetism &Electromagnetic theory

Faraday's law, Concept of displacement current, Maxwell's field equations with physical significance, wave equation in free space, transverse nature of electromagnetic wave. 2L

Module 6: Physics of Nanomaterials (3L)

Reduction of dimensionality, properties of nanomaterials, Quantum wells (two dimensional), Quantum wires (one dimensional), Quantum dots (zero dimensional); Application of nanomaterials (CNT, grapheme, electronic, environment, medical). 3L

Textbook:

1. Engineering Physics by Khan and Panigrahi Publisher: Oxford.

Recommended Books:

Module 1:

1. Advanced Quantum Mechanics-J. J. Sakurai (TMH)
2. Quantum Mechanics-Schiff (Addison-Wesley)
3. Quantum Computation and Quantum Information(10th Anniversary Edition)-Nielsen & Chuang (Cambridge University Press)
4. The physics of quantum information-Dirk Bouwmeester, Artur K. Ekert, Anton Zeilinger (Springer)
5. Quantum Mechanics-Cohen Tanuje.
6. Advanced Quantum Mechanics-P.A.M. Dirac

Module 2:

Statistical Mechanics by B.B. Laud
Statistical Mechanics by Singh and Singh
Statistical Mechanics by Satyaprakash

Module 3:

1 Introduction to solid state physics-Kittel (TMH)
2. Solid State Physics- Ali Omar (Pearson Eduction)
3. Solid state physics- S. O. Pillai

4. Solid State Physics-A. J. Dekker (Prentice-Hall India)
5. Materials Science-Raghavan

Module 4:

Optics-A. K. Ghatak (TMH)
Optics-B.D. Gupta (Books and Allied Publ)

Module 5:

1. Electromagnetics-B.B. Laud (TMH)
2. Electricity Magnetism-B.Ghosh (Book & Allied Publisher)
3. Electricity Magnetism-Chattopadhyay & Rakshit (New Central Book Agency)
4. Electricity Magnetism-Fewkes and Yardwood (Oxford University Press)

Module 6:

6. Nanotechnology-Rakesh Rathi (S. Chand Publishers)
7. Integrated Electronics-Millman Halkias (TMH)
8. Nanotechnology-Rakesh Rathi (S. Chand Publishers)
9. Nanoscience-H. E. Schaefer (Springer)

CO-PO Mapping

CO	PO 1	PO 2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	-	-	-	-	-	-	-	-	-	1
CO2	3	2	-	-	-	-	-	-	-	-	-	2
CO3	2	3	-	-	-	-	-	-	-	-	-	1
CO4	1	2	2	3	-	-	-	-	-	-	-	1

Course Name: Digital Electronics and Computer Organization
Course Code: CS301
Contact: 3:0:0
Total Contact Hours: 36
Credits: 3

Course Outcome(s):

CO1: To realize basic gate operations and laws Boolean algebra.
CO 2: To understand basic structure of digital computer, stored program concept and different arithmetic and control unit operations.
CO3: To understand basic structure of different combinational circuits- multiplexer, decoder, encoder etc.
CO4: To perform different operations with sequential circuits.
CO5: To understand memory and I/O operations.

Course Contents:

Module – 1: [**3L**]

Introduction, concepts and laws of Boolean algebra [1L], Boolean functions and Representation in SOP and POS forms [1L], Minterm and maxterm , Minimization of logic expressions by Karnaugh Map [1L]

Module – 2: [**7L**]

Combinational circuits:

Adder and Subtractor (half-full adder & subtractor) [2L],Carry look ahead adder and Parity Generator[1L], Encoder, Decoder, Multiplexer [2L], De-Multiplexer ,Comparator[[1L], Basic Concepts of A/D and D/A converters[1L]

Module – 3: [**8L**]

Sequential Circuits:

Basic Flip-flop- SR, JK, D, T and JK Master-slave Flip Flops [3L], Registers (SISO, SIPO, PIPO, PISO) [2L]
Ring counter, Johnson counter [1L], Basic concept of Synchronous and Asynchronous counters [1L], Design of Modulo-N Counter [1L],

Module – 4: [9L]

Stored program concept-Von Neumann and Harvard architecture [1L]
Introduction to CPU and concepts of ALU [2L], Instruction format and Instruction Cycle [1L], Addressing Modes [1L]
Fixed-point multiplication - Booth's algorithm. [1L], Fixed-point division - Restoring and non-restoring algorithms. [1L]
Floating-point number representation- IEEE 754 format and Floating-point arithmetic operation [2L]

Module – 5: [**4L**]

Introduction to memory-RAM and ROM [2L], Register transfer, memory transfer, Tri-state bus buffer [1L], Microprogrammed and hardwired control unit [1L]

Module – 6: [5L]

Introduction to I/O operations [1L], Synchronous and asynchronous transfer [1L], Modes of transfer [1L], Bus Arbitration [1L], Input-output processor [1L]

Text Books:

1. David A. Patterson and John L. Hennessy- Computer Organization and Design: The Hardware/Software Interface
2. Morries Mano- Digital Logic Design- PHI

Reference Books:

1. Hayes J. P., “Computer Architecture & Organisation”, McGraw Hill,
2.William Stallings, Computer Organization and Architecture: Designing for Performance

CO-PO Mapping:

CO/PO Mapping	
PO	**Programme Outcomes(POs)**

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

Course Name: Data Structures
Course Code: CS302
Contact: 3:0:0
Total Contact Hours: 36
Credits: 3

Prerequisites:

1. Familiarity with the fundamentals of C or other programming language
2. A solid background in mathematics, including probability, set theory.

Course Outcome:

CO1: To differentiate how the choices of data structure & algorithm methods impact the performance of program.
CO2: To solve problems based upon different data structure & also write programs.
CO3: To identify appropriate data structure & algorithmic methods in solving problem.
CO4: To discuss the computational efficiency of the principal algorithms for sorting, searching, and hashing
CO5: To compare and contrast the benefits of dynamic and static data structures implementations.

Course Content:

Module I: Linear Data Structure [10L]

Introduction (2L):
Concepts of data structures: a) Data and data structure b) Abstract Data Type and Data Type.
Algorithms and programs, basic idea of pseudo-code (1L)
Algorithm efficiency and analysis, time and space analysis of algorithms – order notations (1L)
Array (2L):
Different representations – row major, column major (1L)
Sparse matrix - its implementation and usage, Array representation of polynomials (1L)
Linked List (6L):
Singly linked list – operations, Doubly linked list – operations (4L)
Circular linked list – operations, Linked list representation of polynomial and applications (2L)

Module II: Linear Data Structure [6L]

Stack and Queue (4L):
Stack and its implementations (using array and linked list) (1L)
Applications (infix to Postfix, Postfix Evaluation) (1L)
Queue, circular queue, de-queue (1L)
Implementation of queue- linear and circular (using array and linked list) (1L)
Recursion (2L):
Principles of recursion - use of stack, tail recursion. (1L)
Applications - The Tower of Hanoi(1L)

Module III: Nonlinear Data structures [12L]

Trees (8L):
Basic terminologies, forest, tree representation (using array and linked list) (1L)
Binary trees - binary tree traversal (pre-, in-, post- order) (1L)
Threaded binary tree (1L)
Binary search tree- operations (creation, insertion, deletion, searching) (1L)
Concept of Max-Heap and Min-Heap (creation, deletion) (1L)
Height balanced binary tree – AVL tree (insertion with examples only) (1L)
Height balanced binary tree – AVL tree (deletion with examples only) (1L)
m –Way Search Tree, B Tree – operations (insertion, deletion with examples only) (1L)
Graphs (4L):
Graph theory review (1L)
Graph traversal and connectivity – Depth-first search (DFS), Breadth-first search (BFS) - concepts of edges used in DFS and BFS (tree-edge, back-edge, cross-edge, and forward-edge) (2L)
Minimal spanning tree – Prim's algorithm, Kruskal's algorithm (basic idea of greedy methods) (1L)

Module IV: Searching, Sorting [8L]

Sorting Algorithms (4L):
Bubble sort, Insertion sort, Selection sort – with notion of complexity (1L)
Quick sort, Merge sort – with complexity (2L)
Radix sort – with complexity (1L)
Searching (2L):
Sequential search – with complexity (1L)
Binary search, Interpolation Search– with complexity (1L)
Hashing (2L):
Introduction to Hashing and Hashing functions (1L)
Collision resolution techniques (1L)

Textbooks:

1. Data Structures Through 'C' Language by Samiran Chattopadhyay, Debabrata Ghosh Dastidar, Matangini Chattopadhyay, Edition: 2001, BPB Publications
2. Fundamentals of Data Structures of C by Ellis Horowitz, Sartaj Sahni, Susan Anderson-freed 2nd Edition, Universities Press

Reference Books:

1. Data Structures, Algorithms, and Software Principles in C by Thomas A. Standish, 1 Edition, Pearson
2. Data Structures by S. Lipschutz, Special Indian Edition, Tata McGraw Hill Education (India) Private Limited
3. Data Structures and Program Design In C by Robert L. Kruse, Bruce P. Leung 2nd Edition, Pearson
4. Data Structures in C by Aaron M. Tenenbaum, 1St Edition, Pearson

.

CO-PO Mapping

CO	PO1	PO2	POP3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	2	3	-	-	-	-	3	-	-
CO2	-	-	-	-	-	2	3	2	2	-	-	-

CO3	-	-	1	-	-	-	-	-	2	3	-	-
CO4	-	1	-	-	-	-	-	-	-	-	-	-
CO5	3	-	-	-	-	3	-	-	-	-	-	-

Course Name: Circuit Theory and Network
Course Code: CS303
Contact Hours: 2:0:0 Total Contact Hours: 24
Credits: 2

Prerequisites: Fundamental concepts of Basic Electrical Engineering

Course outcome(s):

At the end of the course, students are able to:
CO1: Understand Kirchhoff's Laws and Networks theorem for simple circuit analyses
CO2: Apply Laplace Transform for steady state and transient analysis
CO3: Analyze the response of Step, Ramp, Impulse, Sinusoidal, Square, Saw tooth signals.
CO4: Understand two port network parameters through solving related numerical problems
CO5: Analyze various types of network topology matrices by using graph theory as applied to electrical network analysis

Course Content:

Module 1: 2L

Introduction: Continuous & Discrete, Fixed & Time varying, Linear and Nonlinear, Passive and Active networks and systems. Independent & Dependent sources, Step, Ramp, Impulse, Sinusoidal, Square, Saw tooth signals.

Module 2: 5L

Network Equations: Formulation of network equations, Source transformation, Loop variable analysis, Node variable analysis. Network theorem: Superposition, Thevenin's, Norton's & Maximum power transfer theorem and Millman's theorem. Solution of Problems with DC & AC sources.

Module 3: 3L

Resonance circuits: Series and parallel resonance- their frequency response, Quality factor, Half Power Points, and bandwidth. Phasor diagrams, Transform diagrams**,** Practical resonant and series circuits, Solution of Problems

Module 4: 2L

Coupled circuits: Magnetic coupling, polarity of coils, polarity of induced voltage, concept of Self and mutual inductance, Coefficient of coupling, Solution of Problems.

Module 5: 3L

Graph of Network: Concept of Tree and Branch, tree link, junctions, **(*)** Incident matrix, Tie set matrix, Determination of loop current and node voltages.

Module 6: 2L

Circuit transients: DC transients in R-L and R-C Circuits with and without initial charge, (*) R-L-C Circuits, AC Transients in sinusoidal R-L, R-C and R-L-C Circuits, Solution of Problems

Module 7: 4L

Laplace transforms: Concept of Complex frequency , transform of *f(t)* into *F(s)* , transform of step, exponential, over damped surge, critically damped surge, damped and un-damped sine functions , properties of Laplace transform , linearity, real differentiation, real integration, initial value theorem and final value theorem , inverse Laplace transform , application in circuit analysis, Partial fraction expansion, Solution of problems.

Module 8: 3L

Two Port Networks Analysis: Relationship of Two port network variables, short circuit admittance parameters, open circuit impedance parameters, transmission parameters, relationship between parameter sets, network functions for ladder network and general network.

Text Books:

1. A. Chakrabarti: Circuit Theory Analysis & Synthesis

Reference Books:

a. Sudhakar:Circuits & Networks:Analysis & Synthesis 2/e TMH New Delhi
b. Roy Choudhury D., "Networks and Systems", New Age International Publishers.

CO-PO Mapping:

CO/PO Mapping												
PO / Cos	Programme Outcomes(Pos)											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	2	-	-	-	-	-	-	**2**	-	-	-
CO2	-	-	2	3	-	-	-	-	-	-	-	-
CO3	3	2	1		-	-	-	-	-	-	-	-
CO4	-	-	2	3	-	-	-	-	-	-	-	--
CO5	2	1	2	-	-	-	1	-	-	-	-	-

Course Name: PHYSICS-II Lab
Course Code: PH 391
Contact: 0:0:3
Credits: 1.5

***At least 7 experiments to be performed during the semester.**

Prerequisites: Experiments done in Physics I

Course Outcome(s):

At the end of the course students' will be able to
CO1: demonstrate experiments allied to their theoretical concepts
CO2: conduct experiments using semiconductors , dielectric and ferroelectrics
CO3: classify various types of magnetic materials
CO4: participate as an individual, and as a member or leader in groups in laboratory sessions actively
CO5: analyze experimental data from graphical representations , and to communicate effectively them in Laboratory reports including innovative experiments

List of Experiments:

Experiments on Module 1: Quantum Mechanics-II (6L)

1. To study current-voltage characteristics, load response, areal characteristics and spectral response of photo voltaic solar cells & measurement of maximum workable power.
2. Measurement of specific charge of electron using CRT.
3. Determination of band gap of a semiconductor.

Experiments on Module 3: Storage and display devices

4. Identification of various types of magnetic materials through the study of Hysteresis loop

Experiments on Module 4 –Polarization

5. To determine the angle of optical rotation of a polar solution using polarimeter

Experiments on Module 5 -Electricity magnetism

6. Study of dipolar magnetic field behavior.
7. Study of hysteresis curve of a ferromagnetic material using CRO.
8. Use of paramagnetic resonance and determination of Lande-g factor using ESR setup.
9. Measurement of Curie temperature of the given sample.
10. Determination of dielectric constant of given sample (frequency dependent).
11. Determination of Hall co-efficient of a semiconductor and measurement of Magnetoresistance of a given semiconductor
12. Study of transducer property: Determination of the thermo-electric power at a certain temperature of the given thermocouple.

In addition to regular 7 experiments it is **recommended that each student should carry out at least one experiment beyond the syllabus/one experiment as Innovative experiment.

Probable experiments beyond the syllabus:

1. Determination of thermal conductivity of a bad conductor by Lees and Chorlton's method.
2. Determination of thermal conductivity of a good conductor by Searle's method.

3. Study of I-V characteristics of a LED.
4. Study of I-V characteristics of a LDR
5. Innovative experiments

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	-	-	-	-	-	-	-	-	-	-	1
CO2	2	1	-	3	-	-	-	-	-	-	-	-
CO3	-	-	2	-	-	-	-	-	-	-	-	1
CO4	-	-	-	-	-	-	-	-	3	-	-	-
CO5	-	-	-	-	-	-	-	-	-	1	-	-

Course Name: Digital Electronics and Computer Organization Lab
Course Code: CS391
Contact: 0:0:3
Credits: 1.5

Prerequisites: Basic concepts of Logicgates, Truth Tables, function realization –minimization of Logic expressions by K-map, Concept of basic components of a digital computer, Binary Arithmetic

Course Outcome(s):

CO1: To design basic gate operations.
CO 2: To design different combinational circuits- adder, subtractor, multiplexer, decoder, encoder etc.
CO3: To design different sequential circuits-flip flops.
CO4: To design memory and I/O operations.
CO5: To design RAM architecture.

Course Contents:

1. A) Realization of basic gates and universal gates.
   B) Realization of basic gates using universal gates.
2. Design a Half adder and Full Adder circuit using basic gates and verify its output.
3. Design a Half subtrator and Full Subtractor circuit using basic gates and verify its output
4. Design an Adder/Subtractor composite unit.
5. Design of a ‘Carry-Look-Ahead’ Adder circuit.
6. Realization of a)Encoder, b)Decoder c) Multiplexer , d) De-MUX , e)Comparator and their Truth Table verification.
7. Realization of RS / JK / D flipflops using logic gates.
8. Design of Shift Register using J-K / D Flip Flop.
9. Realization of Synchronous Up/Down counters.
10. Design of MOD- N Counter
11. Design a composite ALU for multi-bit arithmetic operation.
12. Design of RAM.
13. Innovative Experiments

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	-	-	-	-	-	-	-	-	-	-
CO2	3	3	-	2	-	-	2	-	-	-	-	-
CO3	3	3	-	-	-	-	-	-	-	-	-	-
CO4	-	-	3	3	3	-	-	-	2	-	-	-
CO5	3	2	-	-	-	2	-	-	2	1	2	-

Course Code: Data Structures Lab
Course Code: CS392
Contact: 0:0:3
Credits: 1.5

Perquisites:

1. Computer Fundamentals and principal of computer programming Lab

Course Outcomes:

CO1: Choose appropriate data structure as applied to specified problem definition.

CO2: Handle operations like searching, insertion, deletion, traversing mechanism on various data structures.

CO3: Have practical knowledge on the applications of data structures.

CO4: Able to store, manipulate and arrange data in an efficient manner.

CO5: Able to implement queue and stack using arrays and linked list. Implementation of queue, binary tree and binary search tree.

List of Experiment:

1. Write a C program to implement Single Link List
2. Write a C program to implement Double Link List
3. Write a C program to implement Single Circular Link List
4. Write a C program to implement Double Circular Link List
5. Write a C program to implement Polynomial addition and Polynomial multiplication using Linked List.
6. Write a C program to convert a given infix expression into its postfix Equivalent.
7. Write C programs to implement a queue ADT using i) array and ii) doubly linked list respectively.
8. Write a C program to implement Binary Search Tree (BST).
9. Write C programs for implementing the following sorting methods to arrange a list of integers in ascending order:
   a. Insertion sort
   b. Merge sort
10. Write C programs for implementing the following sorting methods to arrange a list of integers in ascending order:
    a. Quick sort
    b. Selection sort

11. Write C programs for implementing the following searching methods:
   a. Linear Search
   b. Binary Search

Write a C program to implement all the functions of a dictionary (ADT) using hashing.

12. Write C programs for implementing the following graph traversal algorithms:
   a. Depth first search
   b. Breadth first search

13. Innovative experiments

Textbooks:

1. Data Structures using C, R. Thareja, 2nd Edition, Oxford University Press.
2. Data Structures Using C E. Balagurusamy, Mcgraw Hill

Reference Books:

1. Data Structures in C by Aaron M. Tenenbaum, 1st Edition, Pearson
2. Data Structures Through 'C' Language by Samiran Chattopadhyay, Debabrata Ghosh Dastidar, Matangini Chattopadhyay, Edition: 2001, BPB Publications
3. Data structures using C, A.K.Sharma, 2nd Edition, Pearson
4. Fundamentals of Data Structures of C by Ellis Horowitz, Sartaj Sahni, Susan Anderson-freed 2nd Edition, Universities Press

CO-PO Mapping:

CO	PO1	PO2	POP3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	2	2	-	-	-	-	1	-	-
CO2	-	2	2	-	2	-	-	-	-	1	-	2
CO3	2	1	1	-	-	-	-	-	-	-	-	-
CO4	3	2	-	2	-	-	-	-	-	-	1	-
CO5	-	-	2	1	2	-	-	-	-	-	1	2

Course Name: Programming with C++ Lab
Course Code: CS393
Contact: 1:0:2
Credits: 1.5

Perquisites:

Computer Fundamentals and principles of computer programming

Course Outcomes:

CO1: To demonstrate a thorough understanding of modular programming by designing programs that requires the use of programmer-defined functions.

CO2: To demonstrate a thorough understanding of arrays by designing and implementing programs that search and sort arrays.

CO3: To demonstrate a thorough understanding of the object-oriented programming concepts of encapsulation, data abstraction and composition by designing and implementing classes including the use of overloaded functions and constructors.

CO4: To demonstrate a thorough understanding of the concept of pointers and dynamic memory allocation, the implementation of programmer-defined functions and classes by writing code, performing unit testing and debugging of multiple complex programs.

CO5: To demonstrate an understanding of the differences between C and C++ in the areas of strings, pass by reference/passing pointers, and structs by designing and implementing programs that use C

strings, C++ strings, C language structs and classes.

Course Contents:

1. Introduction of UNIX/Linux Operating System which includes preliminary commands, start-up & shutdown methodology, file **[3P]**
2. Handling as well as introduction to editors like Vi editor, introduction to GNU C & C++ compiler, as well as introduction to GNU & GDB script. **[2P]**
3. Introduction to C++, basic loop control, executing programs. [2P]
4. Writing functions, selection statements, review of functions and parameters, command line arguments, recursion, I/O streams, arrays and string manipulation, pointers, structures & unions**. [6P]**
5. Object-Oriented Programming in C++, fundamentals of classes, constructors-destructors. [2P]
6. Dealing with member functions, operator overloading and polymorphism (both static & dynamic). [6P]
7. Dealing with inheritance, derived class handling.[2P]
8. Abstract class, virtual class, overriding, template class, name-space & exception handling. [6P]
9. Dynamic memory allocation, implementation of Linked Lists, using C++. [4P]
10. Innovative experiments

Note: GNU C++ can be used for the programming, since it is free and has no licensing anomaly

Textbooks

1. The C++ Programming Language by Bjarne StroustrupAddison-Wesley publisher
2. Object-Oriented Programming in C++ b by Robert LaforePublisher: Sams

Reference Book

1. Object Oriented Programming with C++ by Balagurusamy McGraw Hill Education; Sixth edition

CO-PO Mapping:

PO / CO	PO1	PO2	POP3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-	2	-	-	-	-	-	-	-	-	-
CO2	-	2	-	-	-	-	-	-	-	-	-	-
CO3	-	-	-	-	-	-	-	-	-	-	2	-
CO4	-	-	-	-	-	-	-	-	-	2	-	-
CO5	3	-	2	-	-	-	-	-	-	-	-	1

Course Name: Behavioral & Interpersonal Skills
Course Code: MC-381
Contact:3:0:0
Total Contact Hours: 36

Course Outcome(s):

CO1: It will equip the student to handle workplace interpersonal communication in an effective manner.
CO2: To enable students with strong oral and written interpersonal communication skills.
CO3: To prepare students to critically analyze workplace situations and take appropriate decisions.

CO4: To make students campus ready through proper behavioral and interpersonal grooming.
CO5: Integration of enhanced skill set to design and frame team based Project Report and Presentation.

Course Contents:

MODULE ONE – INTERPERSONAL COMMUNICATON

1. The skills of Interpersonal Communication.
2. Gender/Culture Neutrality.
3. Rate of Speech, Pausing, Pitch Variation and Tone.
4. Corporate Communication.
5. Branding and Identity.

MODULE TWO- INTERPERSONAL COMMUNICATION BASED ON WORKPLACECOMMUNICATION

6. Workplace Communication.
7. Modes of Communication (Telephone, Conference Call, Team Huddle, Public Relation etc.)
8. Communication with Clients, Customers, Suppliers etc.
9. Organizing/Participating in Business Meeting.
10. Note Taking.
11. Agenda.
12. Minutes.

MODULE THREE – BUSINESS ETIQUETTE AND CORPORATE LIFE

13. Presenting oneself in the Business Environment.
14. Corporate Dressing and Mannerism.
15. Table Etiquette (Corporate Acculturation, Office parties, Client/Customer invitations etc.)
16. E-mail Etiquette.
17. Activity based Case Study.

MODULE FOUR – MOVIE MAKING: CORPORATE BUSINESS MEETING

18. Team based Brainstorming.
19. Process Planning and Developing Plot.
20. People management.
21. Documentation and Scripting.
22. Shooting the Movie: Location and Camera.
23. Post Production and Editing.
24. Movie Review: Feedback and Analysis

LIST OF REFERENCE:

1. Interpersonal Communication, Peter Hartley, Routledge, 1993.
2.Workplace Vagabonds: Career and Community in Changing Worlds of Work, Christina Garsten, Palgrave Macmillan, 2008.
3. Transnational Business Cultures Life and Work in a Multinational Corporation, Fiona Moore, Ashgate, 2005.

4. Global Business Etiquette: A Guide to International Communication and Customs,

Jeanette S. Martin and Lillian H. Chaney, Praeger Publishers, 2006.
5. Making Teams Work: 24 Lessons for Working Together Successfully, Michael Maginn, McGraw-Hill, 2004.
6. Corporate Communications: Convention, Complexity, and Critique, Lars Thøger Christensen, Mette Morsing and George Cheney, SAGE Publications Ltd., 2008.
7. The Business Meetings Sourcebook: A Practical Guide to Better Meetings and Shared Decision Making, Eli Mina, AMACOM, 2002.
8.Moving Images: Making Movies, Understanding Media, Carl Casinghino, Delmar, 2011.

4th Semester

Sl. No	Course Code	Paper Code	Theory	Contact Hours /Week				Credits Points
				L	T	P	Total	
A. THEORY								
1	ES	M(CSE)401	Numerical Methods and Statistics	3	0	0	3	3
2	HS	HU 402	Economics for Engineers	2	0	0	2	2
3	PC	CS401	Computer Architecture	3	0	0	3	3
4	PC	CS402	Design and Analysis of Algorithms	3	0	0	3	3
5	PC	CS403	Formal Language and Automata Theory	3	0	0	3	3
Total of Theory							**14**	**14**
B. PRACTICAL								
6	ES	M(CSE)491	Numerical Methods and Statistics Lab	0	0	3	3	1.5
7	PC	CS491	Computer Architecture Lab	0	0	3	3	1.5
8	PC	CS492	Algorithms Lab	0	0	3	3	1.5
9	PROJ	PR 491	Project-IV	0	0	2	2	1
10	PROJ*	PR 492	Innovative activities-III	0	0	0	0	0.5
C. MANDATORY ACTIVITIES / COURSES								
11	MC	MC401	Constitution of India	3	0	0	3	
Total of Theory, Practical & Mandatory Activities/Courses							**28**	**20**

*Students may choose either to work on participation in all the activities of Institute's Innovation Council for eg: IPR workshop/ Leadership Talks/ Idea/ Design/ Innovation/ Business Completion/ Technical Expos etc.

Innovative activities to be evaluated by the Programme Head/ Event coordinator based on the viva voce and submission of necessary certificates as evidence of activities.

Course Name: Numerical Methods and Statistics
Course Code: M (CSE) 401
Contact: 3:0:0
Total Contact Hours: 36
Credits: 3

Prerequisites:

The students to whom this course will be offered must have the concept of (10+2) standard numbersystem, algebra and calculus.

Course Outcome(s):

On successful completion of the learning sessions of the course, the learner will be able to:
CO1: Recall the distinctive principles of numerical analysis and the associated error measures.CO2: Understand the theoretical workings of numerical techniques.
CO3: Apply numerical methods used to obtain approximate solutions to intractable mathematical problems such as interpolation, integration, the solution of linear and nonlinear equations, and the solution of ordinary differential equations.
CO4: Select appropriate numerical methods to apply to various types of problems in engineering and science in consideration of the mathematical operations involved, accuracy requirements, and available computational resources.
CO5: Interpret complex statistical findings using the understanding of inferential statistics.

Course Contents:

MODULE I: ***Error Analysis and Interpolation (8 Lectures)***

Approximation in Numerical Computation: Truncation and rounding errors, Propagation of errors,Fixed and floating-point arithmetic.

Interpolation: Difference Operators: Forward and Backward, Shift Operator; Newton forwardinterpolation, Newton backward interpolation, Lagrange's Interpolation.

MODULE II: ***Numerical Solution of Linear and Non-linear Equations (8 Lectures)***

Numerical Solution of a System of Linear Equations: Gauss elimination method, LU Factorization method, Gauss-Seidel iterative method.

Solution of Polynomial and Transcendental Equations: Bisection method, Regula-Falsi, Newton-Raphson method.

MODULE III: ***Numerical Integration and Numerical Solution of Differential Equation (6 Lectures)***

Numerical Integration: Trapezoidal rule, Simpson's 1/3 rule, Expression for corresponding error terms.

Numerical solution of ordinary differential equation: Euler's method,Euler's modifiedmethod,Fourth order Runge-Kutta method.

MODULE III: ***Statistics (14 Lectures)***

Basic Statistics: Basic statistics, measure of central tendency, mean, median, mode, dispersion, correlation coefficient and regression.
Sampling theory: Random sampling. Statistic and its Sampling distribution.Sampling distribution of sample mean and variance in random sampling from a normal distribution (statement only) and related problems.

Estimation of parameters: Unbiased and consistent estimators. Interval estimation. Maximum likelihood estimation of parameters (Binomial, Poisson).Confidence intervals and related problems

Textbooks:

1. Shishir Gupta &S.Dey, Numerical Methods, Mc. Grawhill Education Pvt. Ltd.
2. C.Xavier: C Language and Numerical Methods, New age International Publisher.
3. Dutta& Jana: Introductory Numerical Analysis. PHI Learning
4. J.B.Scarborough: Numerical Mathematical Analysis.Oxford and IBH Publishing
5. Jain, M. K., Iyengar, S. R. K. and Jain, R. K. *Numerical Methods (Problems and Solution)*. Newage International Publisher.
6. Prasun Nayek: Numerical Analysis, Asian Books
7. N. G. Das: Statistical Methods, TMH.
8. *Sancheti , D. S. & Kapoor ,V.K. : Statistics Theory , Method & Application,* Sultan chand &sons , New Delhi

Reference Books:

1. Balagurusamy, E. *Numerical Methods*, Scitech. TMH.
2. Dutta, N. *Computer Programming & Numerical Analysis*, Universities Press.
3. Guha, S. and Srivastava, R. *Numerical Methods*, Oxford Universities Press.
4. Shastri, S. S. *Numerical Analysis*, PHI.
5. Mollah, S. A. *Numerical Analysis*, New Central Book Agency.
6. Numerical Methods for Mathematics ,Science&Engg., Mathews, PHI.
7. Rao, G. S. *Numerical Analysis*, New Age International.
8. Rao, G.S, Programmed Statistics (Questions – Answers), New Age International

CO-PO Mapping:

P	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**P10**	**P11**	**P12**

O CO												
CO1	3	1	1	-	-	-	-	-	-	-	-	1
CO2	3	2	1	-	-	-	-	-	-	-	-	1
CO3	3	2	2	-	-	-	-	-	-	-	-	1
CO4	3	3	2	3	-	-	-	-	-	-	-	1
CO5	3	3	2	3	-	-	-	-	-	-	-	1

Course Name: Economics for Engineers
Course Code: HU402Contact: 2:0:0
Total Contact Hours: 24
Credits: 2

Pre-requisites:

MATH – College Algebra, Pre-Calculus Algebra and Trigonometry.

Course Outcome(s):

CO1: Apply the appropriate engineering economics analysis method(s) for problem solving: present worth, annual cost,rate-of-return, payback, break-even, benefit-cost ratio.

CO2: Evaluate the cost effectiveness of individual engineering projects using the methods learned and draw inferences forthe investment decisions.

CO3: Compare the life cycle cost of multiple projects using the methods learned, and make a quantitative decision betweenalternate facilities and/or systems.

CO4: Evaluate the profit of a firm, carry out the break even analysis and employ this tool to makeproduction decision.

CO5: Discuss and solve advanced economic engineering analysis problems including taxation andinflation.

Course Contents:

MODULE I Introduction[3L]

Managerial Economics-Relationship with other disciplines-Firms: Types, Objectives and goals-Managerial Decisions-Decision Analysis.

MODULE II Demand and Supply Analysis[5 L]
Demand-Types of demand-determinants of demand-Demand function-Demand Elasticity-Demand forecasting-Supply-Determinants of supply-Supply function-Supply Elasticity.

MODULE III Cost Analysis[5 L]
Element of costs, Marginal cost, Marginal Revenue, Sunk cost, Opportunity cost, Break-even analysis –PV ratio.

MODULE IV Elementary economic Analysis [4 L]
Inflation-Meaning of inflation, types, causes, measures to control inflation.
National Income-Definition, Concepts of national income, Method of measuring national income.

MODULE V: Financial Accounting [5 L]
Concepts and Definition of Accounting,Journal,Ledger,Trial Balance.TradingA/C,Profit & Loss A/C and Balance Sheet.

MODULE VI: Investment Decision[2L]
Time value of money- Interest - Simple and compound, nominal and effective rate of interest, Cash flow diagrams, Principles of economic equivalence. Evaluation of engineering projects-Present worth method, Future worth method, Annual worth method, Internal rate of return method, Cost benefit analysis for public projects.

Textbooks:
1. Riggs, Bedworth and Randhwa, "Engineering Economics", McGraw Hill Education India
2. Principles of Economics, Deviga Vengedasalam; Karunagaran Madhavan, Oxford University Press.

Reference Books:

1. Engineering Economy by William G.Sullivan, Elin M.Wicks, C. Patric Koelling, Pearson
2. R.Paneer Seelvan, " Engineering Economics", PHI
3. Ahuja,H.L., "Principles of Micro Economics" , S.Chand & Company Ltd
4. Jhingan,M.L., "Macro Economic Theory"
5. Macro Economics by S.P.Gupta, TMH
6. Haniff and Mukherjee,Modern Accounting,Vol-1,TMG
7. Modern Economic Theory – K.K. Dewett (S.Chand)

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	-	-	-	-	-	-	-	-	2	-

CO2	-	-	-	3	-	-	-	-	-	-	-	-
CO3	-	-	-	-	-	-	-	-	-	-	3	-
CO4	-	-	-	-	-	-	-	-	3	-	-	-
CO5	-	-	-	-	-	-	-	-	-	-	1	-

Course Name: Computer Architecture
Course Code: CS401
Contact: 3:0:0
Total Contact Hours: 36
Credits: 3

Perquisites:

Digital Electronics and Computer Organization

Course Outcome(s):

CO1: To iimplement pipelining concepts and parallelism techniques with a prior knowledge of storedprogram methods.
CO2: To evaluate the performance of each type of memory in the hierarchy and their mappingtechniques.
CO3: To analyse the SIMD and MIMD architecture and their interconnection techniques**.**

Course Content:

Module – 1: [5L]Introduction-

Introduction to basic computer architecture [1L], Stored Program Concepts: Von Neumann & Havard Architecture [1L], RISC VS CISC [1L], Amdahl's law [1L], Performance Measure: MIPS, Benchmark Programs(SPECINT,SPECFP).[1L]

Module – 2: [7L]

Different Classification Scheme: Serial Vs. Parallel [1L], Pipelining: Basic concepts, Linear vs. NonLinear, Static vs. Dynamic, Unifunction vs. Multifunction [2L], Instruction Pipeline [1L] Arithmetic pipeline [1L], Hazards: Data hazards, control hazards and structural hazards [1L]Techniques for handling hazards [1L]

Module – 3:[5L]

Pipeline vs. Parallelism, Levels of parallelism, Instruction-Level Parallelism: Basic Concepts [2L], Techniques for Increasing ILP, Superscalar, Super Pipelined and VLIW Processor Architectures [2L], Array and Vector Processors [1L]

Module – 4: [11L]

Memory Hierarchy: Secondary memory [2L], Main Memory[1L], Cache Memory [1L], Cache coherence and synchronization mechanisms[1L], Mapping Technique in cache memory: Direct, Full Associative and Set Associative [3L], Performance Implementation in Cache Memory [1L], Virtual memory Concepts[1L], page replacement policies [1L].

Module–5:[8L]
Multiprocessor
architecture-

Introduction to Parallel Architecture-Different Classification scheme, Performance of Parallel Computers, PRAM model (EREW,CREW,CRCW) [3L], Centralized and Shared- memory architecture: synchronization[2L], Interconnection Network (Omega, Baseline, Butterfly, Crossbar)[3L]

Text Books:

1. **'**Advanced Computer Architecture Parallelism Scalability Programmability', Tata McGraw-HillEducation Private Limited ISBN-13: 978-0-07-053070-6 ISBN-10: 0-07-053070-X
2. Hwang & Briggs—Computer Architecture & Parallel Processing, TMH

Reference Books:

1. Patterson D.A. and Hennessy, J.L. "Computer architecture a quantitative approach", 2nd ed.,Morgan Kaufman, 1996
2. Hayes J. P., "Computer Architecture & Organisation", McGraw Hill
3. Siegel, H.J., "Interconnection Network for Large Scale parallel Processing", 2nd Ed., McGrawHill, 1990
4. Design and Analysis of Parallel Algorithm-Schim G. Akl

CO-PO Mapping:

CO & PO Mapping												
PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	-	-	-	-	-	-	-	-
CO2	3	3	3	3	-	-	-	-	-	-	-	-
CO3	3	2	2	3	-	-	-	-	-	-	-	-

Course Name: Design & Analysis of Algorithm
Course Code: CS402
Contact: 3:0:0

Total Contact hour:
36Credits: 3

Course Outcome(s):

CO1 To understand the concepts of time and space complexity, worst case, average case and best casecomplexities and the big-O notation

CO2 To apply design principles and concepts to algorithm design.

CO3 To understand the mathematical foundation in analysis of algorithms.

CO4 To understand different algorithmic design strategies.

CO5 To analyze the efficiency of algorithms using time and space complexity theory.

Course Contents:

Module 1

Complexity Analysis: [4L]

Time and Space Complexity, Different Asymptotic notations – their mathematical significance. Solving Recurrences: Substitution Method, Recurrence Tree Method, Master Theorem.(Proof of Master theorem)

Module 2

Divide and Conquer: [4L]

Basic method, use, Examples – Binary Search, Merge Sort, Quick Sort and their complexity(all three cases).Heap Sort and its complexity, Multiplication of two large numbers and its time complexity.

Lower Bound Theory: [1L]
O(nlgn) bound for comparison
sort

Module 3

Dynamic Programming: [7L]

Basic method, use, Examples – Matrix Chain Manipulation, Strassen's matrix multiplication algorithm, Longest Common Subsequence, All pair shortest paths (Floyd Warshall), Single source shortest path (Dijkstra, Bellman- Ford), 0/1 Knapsack problem, Travelling Salesman Problem

Disjoint set manipulation: [1L]

Set manipulation algorithm like UNION-FIND, union by rank.

Greedy Method: [5L]

Basic method, use, Examples – Fractional Knapsack problem, Job sequencing with deadlines, Minimum cost spanning tree by Prim's and Kruskal's algorithm, Huffman encoding and decoding

Backtracking: [2L]

Basic method, use, Examples – n-queens problem, Graph coloring problem.

Module 4

String matching problem: [3L]

Different techniques – Naive algorithm, string matching using finite automata, and Knuth, Morris, Pratt (KMP) algorithmwith their complexities.

Amortized Analysis: [1L]

Aggregate, Accounting, and Potential Method.

Network Flow: [3L]

Ford Fulkerson algorithm, Max-Flow Min-Cut theorem (Statement and Illustration)

Module 5

Notion of NP-completeness: [5L]

P class, NP class, NP hard class, NP complete class – their interrelationship, Reductions and Polynomial time Reducibility, Satisfiability problem (3-SAT and 2-SAT), Cook-Levin's theorem (Statement only), Clique decision problem, Vertex Cover problem

Text Books:

1. T. H. Cormen, C. E. Leiserson, R. L. Rivest and C. Stein, "Introduction to Algorithms"
2. E.Horowitz and Shani "Fundamentals of Computer Algorithms"

Reference Books:

1. K.Mehlhorn, "Data Structures and Algorithms" - Vol. I & Vol. 2.
2. S.Baase "Computer Algorithms"
3. A. Aho, J.Hopcroft and J.Ullman "The Design and Analysis of Algorithms" D.E.Knuth "The Art of Computer Programming", Vol. 3 Jon Kleiberg and Eva Tardos, "Algorithm Design"

CO-PO Mapping:

CO & PO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
C01	3	3	3	3	-	-	-	-	-	-	-	-
CO2	3	3	3	3	-	-	-	-	-	-	-	-
CO3	3	2	2	3	-	-	-	-	-	-	-	-
CO4	3	3	3	3	-	-	-	-	-	-	-	-
CO5	3	2	2	3	-	-	-	-	-	-	-	-

Course Name: Formal Language and Automata Theory

Course Code: CS 403
Contacts: 3:0:0
Total Contact Hours: 36
Credits: 3

Prerequisites:

1. Digital Logic
2. Computer organization
3. Computer Fundamentals

Course Outcome(s):

CO1: To acquire the knowledge of the basics of state machines with or without output and its different classifications
CO2: To understand synchronous sequential circuits as the foundation of digital system.
CO3: To apply techniques of designing grammars and recognizers for several programming languages.
CO4: To analyze Turing's Hypothesis as a foreword to algorithms.
CO5: To perceive the power and limitation of a computer, and take decisions on computability.

Course Contents:

Module-1: [9 L]

Fundamentals: Basic definition of sequential circuit, block diagram, mathematical representation, concept of transition table and transition diagram, **[1L]**
Introduction to Finite State Model (FSM), Design of sequence detector, Finite State Machine, Finite Automata, Deterministic Finite Automation (DFA) and Non-deterministic Finite Automation (NFA), Transition diagrams, Transition tables and Language recognizers. **[3L]**
NFA with empty transitions, Equivalence between NFA with and without empty transitions. NFA to DFA conversion. **[2L]**
Minimization of FSM: Minimization Algorithm for DFA, Introduction to Myhill-Nerode Theorem **[2L]**
Limitations of FSM, Application of Finite Automata **[1L]**

Module-2: [7 L]

Finite Automata with output − Moore & Mealy machine. Representation of Moore & Mealy Machine, Processing of the String through Moore & Mealy Machine, Equivalence of Moore & Mealy Machine – Inter-conversion. **[2L]**

Equivalent states and Distinguishable States, Equivalence and k-equivalence, Minimization of Mealy Machine **[1L]**

Minimization of incompletely specified machine − Merger Graph, Merger Table, Compatibility Graph **[2L]**

Lossless and Lossy Machine – Testing Table, Testing Graph **[2L]**

Module-3: [5 L]

Regular Languages, Regular Sets, Regular Expressions, Algebraic Rules for Regular Expressions,Arden's Theorem statement and proof**[1L]**

Constructing Finite Automata (FA) for given regular expressions, Regular string accepted by FA **[2L]**

Constructing Regular Expression for a given Finite Automata **[1L]**

Pumping Lemma of Regular Sets. Closure properties of regular sets **[1L]**

Module-4: [9 L]

Grammar Formalism - Context Free Grammars, Derivation trees, sentential forms. Right most andleftmost derivation of strings, Parse Tree, Ambiguity in context free grammars. **[1L]**

Minimization of Context Free Grammars. **[1L],** Removal of null and unit production **[1L]**

Chomsky normal form and Greibach normal form. **[1L]**

Pumping Lemma for Context Free Languages. **[1L]**

Enumeration of properties of CFL, Closure property of CFL, Ogden's lemma & its applications **[1L],**

Regular grammars − right linear and left linear grammars**[1L]**

Push down Automata: Push down automata, definition. Introduction to DCFL, DPDA, NCFL, NPDA**[1L]**

Acceptance of CFL, Acceptance by final state and acceptance by empty state and its equivalence. **[1L]**

Equivalence of CFL and PDA, inter-conversion. **1L]**

Module-5: [5L]

Turing Machine: Turing Machine, definition, model **[1L]**

Design of TM, Computable functions

[1L] Church's hypothesis, counter

machine **[1L]**Types of Turing

machines **[1L]**

Universal Turing Machine, Halting problem **[1L]**

Textbook:

1. "Introduction to Automata Theory Language and Computation", Hopcroft H.E. and Ullman J. D., Pearson Education.

Reference Books:

1. "Formal Languages and Automata Theory", C.K.Nagpal, Oxford
2. "Switching and Finite Automata Theory", Zvi Kohavi, 2nd Edition., Tata McGraw Hill

CO-PO Mapping:

	CO/PO Mapping											
CO	**Programme Outcomes (POs)**											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	3	-	-	-	-	-	-	-	-	-	-
CO2	3	-	2	-	-	-	-	-	-	-	-	-
CO3	3	-	-	2	-	-	-	-	-	-	-	-
CO4	-	3	-	3	-	-	-	-	-	-	-	-
CO5	-	3	-	2	-	-	-	-	-	-	-	2

Course Name: Numerical Methods And Statistics (Lab)

Course Code: M (CSE) 491

Contact: 0:0:3

Credits: 1.5

Prerequisites: Any introductory course on programming language (example. C/Matlab).

Course Outcome (s):

On successful completion of the learning sessions of the course, the learner will be able to: CO1: Understand the theoretical workings of numerical techniques with the help of C/ MatlabCO2: Execute basic command and scripts in a mathematical programming language
CO3: Apply the programming skills to solve the problems using multiple numerical approaches. CO4: Analyze if the results are reasonable, and then interpret and clearly communicate the results.

List of Experiment:

1. Assignments on Newton forward /backward, Lagrange's interpolation.
2. Assignments on numerical integration using Trapezoidal rule, Simpson's 1/3 rule
3. Assignments on numerical solution of a system of linear equations using Gauss

elimination,Gauss Jacobi and Gauss-Seidel iterations.

4. Assignments on numerical solution of Algebraic Equation by Bisection method, Regula-Falsimethod, Newton-Raphson method.
5. Assignments on ordinary differential equation: Euler's method, Euler's modified method, Runge-Kutta methods.
6. Simple problems as assignment on Measures of Central Tendency- mean, median, mode, Measures of Dispersion- variance, standard deviation. Problems related to engineering field.
7. Innovative Experiments

Implementation of numerical methods on computer through C/C++ and commercial Software Packages: Matlab / Scilab / Labview / Mathematica/NAG (Numerical Algorithms Group/Python.

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10	P11	P12
CO1	3	2	1	-	-	-	-	-	-	-	-	1
CO2	3	2	2	-	-	-	-	-	-	-	-	1
CO3	3	2	2	-	-	-	-	-	-	-	-	1
CO4	3	3	2	3	-	-	-	-	-	-	-	1

Course Name: Computer Architecture Lab
Course Code: CS491
Contact: 0:0:3
Credits: 1.5

Prerequisites:

Knowledge of designing different circuits in Computer Organization Lab

Course Outcome(s):

CO1: To design the basic
gatesCO2: To verify the
truth table
CO3: To design circuit using Xilinx tools

List of Experiment:

1. Implement different types of Basic gates and simulate for truth table verification.
2. Implement half adder circuit and simulate for truth table verification.
3. Implement full adder circuit and simulate for truth table verification.
4. Implement half subtractor circuit and simulate for truth table verification.
5. Implement full subtractor circuit and simulate for truth table verification.

6. Implement Multiplexer, DeMultiplexer circuit and simulate for truth table verification.
7. Implement Encoder, Decoder circuit and simulate for truth table verification.
8. Implement different types of flip flop and simulate for truth table verification.
9. Implement different types of parallel circuits (SISO,SIPO,PISO,PIPO) and simulate the result.
10. Implement ALU and simulate the result.
11. Implement RAM chip and simulate the result.
12. Innovative Experiments.

CO-PO Mapping:

CO \ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10	P11	P12
CO1	3	-	-	-	-	-	-	-	-	-	-	-
CO2	-	2	-	-	-	-	-	-	-	-	-	-
CO3	3	3	3	-	-	-	-	-	-	-	-	-

Course Name: Design & Analysis of Algorithm Lab
Course Code: CS492
Contact:0:0:3
Credits: 1.5

Prerequisites:

Programming Knowledge.

Course Outcome(s): Student will be able to:

CO1: To prove the correctness and analyze the running time of the basic algorithms for those classic problems in various domains.
CO2: To understand methods for analyzing the efficiency and correctness of algorithms (such asexchange arguments, recurrence, induction, and average case analysis)
CO3: To design algorithms using the dynamic programming, greedy method, Backtracking, Branch andBound strategy, and recite algorithms that employ this strategy
CO4: To compare, contrast, and choose appropriate algorithmic design techniques to present an algorithm that solves a given problem.
CO5: To Identify and analyze criteria and specifications appropriate to new problems.

List of Experiment:

Write the following problems in any programming language. Programming Language used: C

1. Divide and Conquer:

a. Implement Binary Search (Recursive & Iterative) using Divide and Conquer approach
b. Implement Merge Sort using Divide and Conquer approach
c. Implement Quick Sort using Divide and Conquer approach
d. Implement Heap Sort using Divide and Conquer approach
e. Find Maximum and Minimum element from a array of integer using Divide and Conquer approach

2. Dynamic Programming:

a. Find the minimum number of scalar multiplication needed for chain of matrix
b. Implement all pair of Shortest path for a graph (Floyed Warshall Algorithm)
c. Implement Single Source shortest Path for a graph (Dijkstra , Bellman Ford)
d. Implement Longest Common Subsequence problem

3. Backtracking:

a. Implement n-Queens Problem
b. Graph Coloring Problem

4. Greedy method:

a. Knapsack Problem
b. Job sequencing with deadlines
c. Minimum Cost Spanning Tree by Prim's Algorithm
d. Minimum Cost Spanning Tree by Kruskal's Algorithm

5. Innovative experiments

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10	P11	P12
CO1	3	2	1	-	-	-	-	-	-	-	-	1
CO2	3	2	2	-	-	-	-	-	-	-	-	1
CO3	3	2	2	-	-	-	-	-	-	-	-	1
CO4	3	3	2	3	-	-	-	-	-	-	-	1
CO5	3	3	2	1	-	-	-	-	-	-	-	-

Course Name: Constitution of India

Course Code: MC401

Contact: 3:0:0

Total Contact Hours: 32

Course Outcome(s): Student will be able to:

CO1: Develop human values , create awareness about law ratification and significance of Constitution

CO2: Comprehend the Fundamental Rights and Fundamental Duties of the Indian Citizen to implant morality, social values and their social responsibilities.

CO3: Create understanding of their Surroundings, Society, Social problems and their suitable solutions.

CO4: Familiarize with distribution of powers and functions of Local Self Government.

CO5: Realize the National Emergency, Financial Emergency and their impact on Economy of the country.

Course content:

1. Meaning of the constitution law and constitutionalism (2L)
2. Historical perspective of the Constitution of India (2L)
3. Salient features and characteristics of the Constitution of India (1L)
4. Scheme of the fundamental rights (2L)
5. The scheme of the Fundamental Duties and its legal status (2L)
6. The Directive Principles of State Policy – Its importance and implementation (2L)
7. Federal structure and distribution of legislative and financial powers between the Union and the States (3L)
8. Parliamentary Form of Government in India – The constitution powers and statusof the President of India (2L)
9. Amendment of the Constitutional Powers and Procedure (2L)
10. The historical perspectives of the constitutional amendments in India (2L)
11. Emergency Provisions: National Emergency, President Rule, Financial Emergency (3L)
12. Local Self Government – Constitutional Scheme in India (3L)
13. Scheme of the Fundamental Right to Equality (2L)
14. Scheme of the Fundamental Right to certain Freedom under Article 19 (2L)
15. Scope of the Right to Life and Personal Liberty under Article 21. (2L)

Textbooks:

1. Introduction to Constitution of India, D.D. Basu, Lexis Nexus
2. The Constitution of India, PM Bhakshi, Universal Law

CO-PO mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	-	-	-	3	2	3	-	-	-	2
CO2	-	-	-	-	-	3	2	3	-	-	-	2
CO3	-	-	-	-	-	3	2	3	-	1	-	2
CO4	-	-	-	-	-	3	2	3	-	1	-	2
CO5	-	-	-	-	-	3	2	3	-	1	-	2

5th Semester								
Sl. No.	**Course Code**	**Paper Code**	**Theory**	**Contact Hours /Week**				**Credit Points**
				L	**T**	**P**	**Total**	
1	PC	CS501	Computer Graphics	3	0	0	3	3
2	PC	CS502	Operating System	3	0	0	3	3
3	PC	CS503	Data Base Management System	3	0	0	3	3

4	OE	CS504	A. Object Oriented Programming using Java B. Multimedia Technology C. Communication Engineering	3	0	0	3	3
5	PE	CS505	A. Operations Research B. Computational Geometry C. Distributed Algorithms	3	0	0	3	3
Total of Theory							15	15
6	PC	CS591	Computer Graphics Lab	0	0	3	3	1.5
7	PC	CS592	Operating System Lab	0	0	3	3	1.5
8	PC	CS 593	Data Base Management System Lab	0	0	3	3	1.5
9	OE	CS594	A. Object Oriented Programming Lab B. Multimedia Technology Lab C. Communication Engineering Lab	0	0	3	3	1.5
10	PROJ	PR 591	Project-V	0	0	2	2	1
11	PROJ*	PR 592	Innovative activities-IV	0	0	0	0	0.5
C. MANDATORY ACTIVITIES / COURSES								
12	MC	MC 501	Environmental Science	3	0	0	3	
Total of Theory, Practical & Mandatory Activities/Courses							**32**	**22.5**

* Students may choose either to work on participation in Hackathons etc. Development of new product/ Business Plan/ registration of start-up.

Students may choose to undergo Internship / Innovation / Entrepreneurship related activities. Students may choose either to work on innovation or entrepreneurial activities resulting in start-up or undergo internship with industry/ NGO's/ Government organizations/ Micro/ Small/ Medium enterprises to make themselves ready for the industry/ Long Term goals under rural Internship. (Duration 4-6 weeks)

Innovative activities to be evaluated by the Programme Head/ Event coordinator based on the viva voce and submission of necessary certificates as evidence of activities.

Course Name: Computer Graphics
Course Code: CS501
Contact: 3:0:0

Total Contact Hours: 36
Credits: 3

Perquisites:

Mathematics, Computer Fundamentals & Principle of Computer Programming

Course Objectives:

- To introduce the use of the components of a graphics system and become familiar with building approach of graphics system components and algorithms related with them.
- To learn the basic principles of 2D and 3D computer graphics.
- To provide an understanding of how to scan convert the basic geometrical primitives, how to transform the shapes to fit them as per the picture definition.
- To provide an understanding of mapping from a world coordinates to device coordinates, clipping, and projections.
- To be able to discuss the application of computer graphics concepts in the development of computer games, information visualization, and business applications.

Course Outcome(s):

CO1: To explain the foundations of computer graphics and different display technology and devices.
CO2: To develop the concept of geometric, mathematical and algorithmic approach necessary for programming computer graphics.
CO3: To implement clipping with the comprehension of windows, view-ports in relation to images display on screen.
CO4: To analyze and compare different hidden surface illumination methods.

Course Contents:

Module-I

Introduction to computer graphics [3L]

Overview of computer graphics, Basic Terminologies in Graphics, lookup table,3D viewing devices, Plotters, printers, digitizers, light pens etc., Active &Passive graphics, Computer graphics software.

Display[3L]

Light &Color models, Raster Scan and Random scan displays, CRT basics, video basics, Flat panel displays, Interpolative shading model

Module-II

Scan conversion: [8L]

Points & 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

Module-III

2D and 3D Transformation [10L]

Basic transformations: translation, rotation, scaling, Matrix representations & homogeneous coordinates, transformations between coordinate systems, reflection shear, Transformation of points, lines, parallel lines, intersecting lines.

3D transformations: translation, rotation, scaling.

2D-Viewing & Clipping [4L]

Viewing pipeline,Window to viewport co-ordinate transformation.

Clipping operations:Point clipping, Cohen Sutherland line clipping algorithm, Weiler Atherton line clipping algorithm, Polygons Clipping, Viewport clipping

Module-IV

Projection [3L]

Basic concepts of different type of projections

Curves [2L]

Bezier curves, B-spline curves

Hidden Surface Removal[3L]

Z-buffer algorithm, Back face detection, BSP tree method, Painter's algorithm

Textbooks:

1. Computer Graphics C Version by Donald Hearn, M. Pauline Baker, Pearson education
2. Computer Graphics by Samit Bhattacharya, Oxford University Press.

Reference Books:

1. Schaum's outlines Computer Graphics (2nd Ed.)by Ray A. Plastock, Gordon Kalley, McGraw-Hill Inc.

2. Mathematical Elements for Computer Graphics by David Rogers, J. Alan Adams,McGraw Hill Education.

CO-PO Mapping:

CO & PO Mapping												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	3	-	-	1	-	-	-	-	-	-	-
CO2	3	3	-	2	-	-	-	-	-	-	-	-
CO3	2	-	-		3	-	-	-	-	-	-	-
CO4	-	-	3	2	-	-	-	-	-	-	-	-

Course Name: Operating System
Course Code: CS502
Contact: 3:0:0
Total Contact Hours: 36
Credits: 3

Prerequisites:
1. Computer organization
2. Computer Architecture
3. Data Structures.
4. Algorithms & Programming Concept

Course Objective(s):

1. To understand the services provided by and the design of an operating system.
2. To understand the structure and organization of the file system.
3. To understand what a process is and how processes are synchronized and scheduled.

4. To understand different approaches to memory management.
5. Students should be able to use system calls for managing processes, memory and the file system.
6. Students should understand the data structures and algorithms used to implement an OS.

Course Outcome(s):

CO1: Describe how computing resources (such as CPU, memory and I/O) are managed by the operating system.

CO2: Analyze kernel and user mode in an operating system.

CO3: Solve different CPU scheduling problem to achieve specific scheduling criteria.

CO4: Apply the knowledge of process management, synchronization, deadlock to solve basic problems.

CO5: Evaluate and report appropriate design choices when solving real-world problems

Course Contents:

Module – 1: [3L]
Functionalities of Operating System, Evolution of Operating System.
Types of Operating System: batch, multi-programmed, time-sharing, real-time, distributed, parallel, Structural overview, Protection & Security. [3L]

Module – 2: [10L]
Processes: Concept of processes, process states, PCB, process scheduling, co-operating processes, independent process, suspended process, Interaction between processes and OS, Inter-process communication: Message passing. [3L]
Threads: overview, benefits of threads, user and kernel level threads, Thread models. [2L]
CPU scheduling: scheduling criteria, preemptive & non-preemptive scheduling, scheduling algorithms (FCFS, SJF, SRTF, RR, priority, multilevel queue, multilevel feedback queue scheduling)[5L]

Module – 3: [11L]
Process Synchronization: background, critical section problem, synchronization hardware, classical problems of synchronization(producer-consumer, readers-writer, dining philosophers, etc), semaphores, monitors. [6L]
Deadlocks: deadlock characterization, methods for handling deadlocks, deadlock prevention, deadlock avoidance, deadlock detection, recovery from deadlock.
[5L]

Module – 4: [6L]
Background, logical vs. physical address space, swapping, contiguous memory allocation, paging, Segmentation, TLB.[3L]
Virtual Memory: background, demand paging, page replacement algorithms (FCFS, LRU, Optimal), thrashing, Working set model.[3L]

Module – 5: [6L]

Disk structure, disk scheduling (FCFS, SSTF, SCAN,C-SCAN,LOOK,C-LOOK etc),disk reliability, disk formatting, boot block, bad blocks. [2L]
File: File concept, access methods, directory structure, file system structure, UNIX file structure, allocation methods (contiguous, linked, indexed), free-space management (bit vector) [2L]
I/O: I/O hardware, polling, interrupts, DMA, caching, buffering, blocking-non blocking I/O. [2L]

Textbooks:
1. Abraham Silberschatz, Peter B. Galvin, Greg Gagne, Operating System Concepts.
2. Operating Systems & Systems Programming by P Balakrishna Prasad

Reference Books:
1. Dietel H. N., "An Introduction to Operating Systems", Addison Wesley.
2. Andrew Tanenbaum, Modern Operating Systems, Prentice Hall.
3. William Stallings, Operating Systems, Prentice Hall.

CO-PO Mapping:

CO & PO Mapping												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	-	-	3	-	-	-	-	-	-	3
CO2	3	3	-	-	-	-	-	-	-	-	-	2
CO3	2	2	-	-	-	-	2	-	-	-	-	3
CO4	3	2	-	-	-	-	3	-	-	-	-	2
CO5	3	2	-	-	-	-	-	-	-	-	-	2

Course Name: DATABASE MANAGEMENT SYSTEM
Course Code: CS503
Contact: 3:0:0
Total Contact Hours: 36
Credits: 3

Prerequisites:
1. Logic of programming language
2. Basic concepts of data structure and algorithms

Course Objectives:
1. To learn the data models, conceptualize and depict a database system

2. To design system using E-R diagram.
3. To learn SQL & relational database design.
4. To understand the internal storage structures using different file and indexing techniques.
5. To know the concepts of transaction processing, concurrency control techniques and recovery procedure**.**

Course Outcome(s):

On completion of the course students will be able to

CO1: Apply the knowledge of Entity Relationship (E-R) diagram for an application.
CO2: Create a normalized relational database model
CO3: Analyze real world queries to generate reports from it.
CO4: Determine whether the transaction satisfies the ACID properties.
CO5: Create and maintain the database of an organization.

Course Contents:

Module 1:

Introduction [3L]

Concept & Overview of DBMS, Data Models, Database Languages, Database Administrator, Database Users, Three Schema architecture of DBMS.

Module 2:

Entity-Relationship and Relational Database Model [9L]

Basic concepts, Design Issues, Mapping Constraints, Keys, Entity-Relationship Diagram, Weak Entity Sets, Extended E-R features, case study on E-R Model. Structure of relational Databases, Relational Algebra, Relational Calculus, Extended Relational Algebra Operations, Views, Modifications Of the Database.

Module 3:

SQL and Integrity Constraints [6L]

Concept of DDL, DML, DCL. Basic Structure, Set operations, Aggregate Functions, Null Values, Domain Constraints, Referential Integrity Constraints, assertions, views, Nested Subqueries, Database security application development using SQL, Stored procedures and triggers.

Module 4:

Relational Database Design [6L]

Functional Dependency, Different anomalies in designing a Database., Normalization using functional dependencies, Decomposition, Boyce-Codd Normal Form, 3NF, Normalization using multi-valued dependencies, 4NF, 5NF , Case Study

Module 5:
Internals of RDBMS [6L]
Physical data structures, Query optimization: join algorithm, statistics and cost bas optimization. Transaction processing, Concurrency control and Recovery Management: transaction model properties, state serializability, lock base protocols; two phase locking, Dead Lock handling

Module 6:
File Organization & Index Structures [6L]
File & Record Concept, Placing file records on Disk, Fixed and Variable sized Records, Types of Single-Level Index (primary, secondary, clustering), Multilevel Indexes

Textbooks:
1. Henry F. Korth and Silberschatz Abraham, "Database System Concepts", Mc.Graw Hill.
2. Elmasri Ramez and Novathe Shamkant, "Fundamentals of Database Systems", Benjamin Cummings Publishing. Company.

Reference Books:
1. Jain: Advanced Database Management System CyberTech
2. Date C. J., "Introduction to Database Management", Vol. I, II, III, Addison Wesley.
3. "Fundamentals of Database Systems", Ramez Elmasri, Shamkant B.Navathe, Addison Wesley Publishing Edition
4. Gray Jim and Reuter Address, "Transaction Processing : Concepts and Techniques", Moragan Kauffman Publishers.
5. Ullman JD., "Principles of Database Systems", Galgottia Publication.

CO-PO MAPPING:

CO s	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	2	2	3	2	1	1	2	2	3	3	2	2	1
CO2	2	3	3	3	3	1	1	1	2	2	3	3	2	2	2
CO3	3	3	2	3	3	2	2	2	3	3	3	3	3	2	2
CO4	3	3	2	2	2	1	1	1	1	1	2	3	2	1	1
CO5	3	3	3	3	3	2	2	2	3	3	3	3	3	2	2

Course Name: Object Oriented Programming using Java
Course Code: CS504A
Contact: 3:0:0
Total Contact Hours: 36
Credits: 3

Course Objectives:

- It allows to map with real world Object (Object orientation) rather than action(Procedure) that comes to produce software as separated code modules which rise up decoupling and increases code re-usability.
- It demonstrates that how can you change the implementation of an object without affecting any other code by increasing data security and protecting unwanted data access. (Encapsulation).
- It allows you to have many different functions, all with the same name, all doing the same job, but depending upon different data. (Polymorphism).
- It guides you to write generic code: which will work with a range of data, so you don't have to write basic stuff over, and over again. (Generics).
- It lets you write a set of functions, then expand them in different direction without changing or copying them in any way. (Inheritance)

Course Outcome(s):

CO1: Design the process of interaction between Objects, classes & methods w.r.t. Object Oriented Programming.
CO2: Acquire a basic knowledge of Object Orientation with different properties as well as different features of Java.
CO3: Analyze various activities of different string handling functions with various I/O operations.
CO4: Discuss basic code reusability feature w.r.t. Inheritance, Package and Interface.
CO5**:** Implement Exception handling, Multithreading and Applet (Web program in java) programming concept in Java.

Course Contents:

Module 1: [5L]

Introduction:

Object Oriented Analysis & Design-Concepts of object oriented programming language, Object, Class.**[1L];** Relationships among objects and classes-Generalization, Specialization, Aggregation, Association, Composition, links, Meta-class. **[1L] ;**Object Oriented Programming concepts - Difference between OOP and other conventional programming – advantages and disadvantages. Class, object, Method. **[1L];**

Properties of OOP- message passing, inheritance, encapsulation, polymorphism, Data abstraction. **[1L];** Difference between different OOPs Languages. **[1L].**

Module 2: [9L]

Java Basics:

Basic concepts of java programming - Advantages of java, Byte-code & JVM, Data types, Different types of Variables. **[1L] ;**Access specifiers, Operators, Control statements & loops. **[1L];** Array. **[1L] ;**Creation of class, object, method. **[1L];** Constructor- Definition, Usage of Constructor, Different types of Constructor. **[1L];** finalize method and garbage collection, Method & Constructor overloading. **[1L];** this keyword, use of objects as parameter & methods returning objects. **[1L];** Call by value & call by reference. **[1L];** Static variables & methods. Nested & inner classes. **[1L].**

Module 3:[4L]

Basic String handling & I/O :

Basic string handling concepts- Concept of mutable and immutable string, Methods of String class-charAt(), compareTo(), equals(), equalsIgnoreCase(), indexOf(), length() , substring(). **[1L];** toCharArray(), toLowerCase(), toString(), toUpperCase() , trim() , valueOf() methods, Methods of String buffer class-append(), capacity(), charAt(), delete(), deleteCharAt(). **[1L];**

ensureCapacity(), getChars(), indexOf(), insert(), length(), setCharAt(), setLength(), substring(), toString(). **[1L] ;**Command line arguments, basics of I/O operations – keyboard input using BufferedReader& Scanner classes. **[1L].**

Module 4: [8L]

Inheritance and Java Packages :

Inheritance - Definition, Advantages, Different types of inheritance and their implementation. **[1L] ;**Super and final keywords, super() method. **[1L];** Method overriding, Dynamic method dispatch. **[1L];** Abstract classes & methods. **[1L];** Interface - Definition, Use of Interface. **[1L];**

Multiple inheritance by using Interface. **[1L] ;**Java Packages -Definition, Creation of packages. **[1L];** Importing packages, member access for packages. **[1L]**

Module 5: [10L]

Exception handling, Multithreading and Applet Programming :

Exception handling - Basics, different types of exception classes. Difference between Checked & Unchecked Exception. **[1L];** Try & catch related case studies.**[1L];** Throw, throws & finally. **[1L];** Creation of user defined exception. **[1L];** Multithreading - Basics, main thread, thread life cycle.**[1L];** Creation of multiple threads-yield(), suspend(), sleep(n), resume(), wait(), notify(), join(), isAlive().**[1L] ;**Thread priorities, thread synchronization.**[1L];**Interthread communication, deadlocks for threads**[1L];** Applet Programming - Basics, applet life cycle, difference between application & applet programming**[1L];** Parameter passing in applets. **[1L]**

Textbooks:

1. Herbert Schildt – "Java: The Complete Reference " – 9th Ed. – TMH
2. E. Balagurusamy – " Programming With Java: A Primer " – 3rd Ed. – TMH.

Reference Books:

1. R.K Das – " Core Java for Beginners " – VIKAS PUBLISHING.
2. Rambaugh, James Michael, Blaha – " Object Oriented Modelling and Design " – Prentice Hall, India.

CO-PO Mapping:

COs	**Programme Outcomes(POs)**											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	3	2	-	-	-	-	-	-	-	-	-
CO2	3	2	-	-	-	-	-	-	-	-	-	-
CO3	3	3	3	1	-	-	2	-	2	-	-	-
CO4	-	-	2	-	-	-	-	-	-	-	-	-
CO5	-	-	-	-	2	-	-	-	2	2	2	-

Course Name: Multimedia Technology
Course CodeCS504B
Contact: 3:0:0
Total Contact Hours: 36
Credits: 3
Prerequisites: Computer Graphics

Course Objectives:

After understanding different technical aspects of Multimedia Systems specially the standards available for different audio, video and text applications, students can be able to Design and develop various Multimedia Systems applicable in real time. Then can deal with various network related issues used for multimedia audio, video and image related applications. The knowledge is very essential for a student to develop any audio-visual multimedia application and analyze the performance of the same.

Course Outcome(s):

CO1 To understand different media; representations of different multimedia data and data formats.
CO2 To analyze various compression techniques.
CO3 To evaluate and create various audio and video file formats.
CO4 To describe optical storage media along with different coding technique for solving real life multimedia application.

Course Contents:

Module 1: Introduction, Text and Audio [6L]

Multimedia: Impact of Multimedia, Multimedia Systems, Components and Its Applications. 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.

Module 2: Image and Video (15L)

Image: Formats, Image Color Scheme, Image Enhancement, Image representation, segmentation; Lossless Image Compression: Huffman Coding, Arithmetic and Lempel-Ziv Coding; Lossy Image Compression Systems: Theory of Quantization, Delta Modulation and DPCM, Transform Coding & K-L Transforms, Discrete Cosine Transforms; Image retrieval: Image retrieval by color, shape and texture.

Video: Analogue and Digital Video, Recording Formats and Standards (JPEG, MPEG, H.261) Transmission of Video Signals, Video Capture, and Computer based Animation,Different Case studies- QBIC, Virage. Video Content, querying, video segmentation, Indexing- kd trees, R-trees, quad trees

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Module 3: Synchronization, Multi-Resolution Analysis, Storage models and Access Techniques [8L]

Temporal relationships, synchronization accuracy specification factors, quality of service, Magnetic media, optical media, file systems (traditional, multimedia); Multimedia devices: Output devices, CD-ROM, DVD, Scanner, CCD,Theory of Wavelets, Theory of Subband Coding (z-transform), Multi-resolution Analysis: Discrete Wavelet Transforms.

Module 4: Embedded Wavelet Coding and Multimedia Applications (7L)

Zerotree Approach, SPIHT algorithm and EBCOT Algorithm, Interactive television, Video-on-demand, Video Conferencing, Educational Applications, Industrial Applications, Multimedia archives and digital libraries, media editors.

Textbooks:

1. Ralf Steinmetz and KlaraNahrstedt , Multimedia: Computing, Communications & Applications , Pearson Ed.
2. Fred Halsall , Multimedia Communications , Pearson Ed.

Reference Books:

1. KoegelBuford , Multimedia Systems , Pearson Ed.
2. Nalin K. Sharda , Multimedia Information System , PHI.
3. Fred Hoffstetter , Multimedia Literacy , McGraw Hill.
4. J. Jeffcoate , Multimedia in Practice: Technology and Application , PHI.
5. Prabhat K. Andleigh& Kiran Thakrar , Multimedia Systems Design , PHI.

CO-PO Mapping:

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

Course Name: Communication Engineering
Course Code: CS 504C
Contact: 3:0:0

Total Contact Hours: 36

Credits: 3

Prerequisites: Knowledge in different types of signals.

Course Objectives:

To present the fundamentals of analog and modern digital communication system design. Students should evaluate the performance of analog and digital signaling schemes on realistic communication channels. Emphasis is placed on physical layer digital communications and coding techniques, including waveform analysis, transmitter design and receiver design. The student will learn about theoretical bounds on the rates of digital data transportation systems.

Course outcome(s):

On completion of the course students will be able to

CO1: Apply the fundamental concepts of engineering principles in design issues in various communication systems.

CO2: Apply the basic concepts for analyzing the modulation techniques including amplitude modulation (AM), frequency modulation (FM) and phase modulation (PM) that are widely used in analogue communication systems in the time and frequency domains.

CO3: Demonstrate the concepts of sampling, Pulse Modulation techniques and their comparison.

CO4: Illustrate various types of coherent and non-coherent digital modulation techniques, analyse immunity parameters and calculate their error probabilities.

Course Contents:

Module - 1: **Elements of Communication system, Analog Modulation & Demodulation, Noise, SNR. (Basic ideas in brief) [10L]**

Introduction to Base Band transmission & Modulation (basic concept) (1L); Elements of Communication systems (mention of transmitter, receiver and channel); origin of noise and its effect, Importance of SNR in system design (1L); Basic principles of Linear Modulation (Amplitude Modulation, DSB-SC, SSB-SC and VSB) (4L); Basic principles of Non-linear modulation (Angle Modulation - FM, PM) (1L); Sampling theorem, Sampling rate, Impulse sampling, Reconstruction from samples, Aliasing (1L); Analog Pulse Modulation - PAM (Natural & flat topped sampling), PWM, PPM (1L). Multiplexing - TDM, FDM (1L).

Module - 2: Digital Transmission: [9L]

Concept of Quantisation & Quantisation error, Uniform Quantiser (2L); Non-uniform Quantiser, A-law &μ-law companding (mention only) (1L); concept of Pulse Code Modulation ; Delta modulation, Adaptive delta modulation, DPCM (basic concept and importance only, no details) (2L); Encoding, Coding efficiency (1L); Line coding & properties, NRZ & RZ, AMI, Manchester coding (2L); Baseband Pulse Transmission(1L)

Module - 3: Digital Carrier Modulation & Demodulation Techniques: [9L]

Bit rate, Baud rate (1L); M-ary encoding, Introduction to the different digital modulation techniques - ASK, FSK, PSK, BPSK, QPSK, mention of 8 BPSK, 16 BPSK (5L); Introduction to QAM, mention of 8QAM, 16 QAM without elaboration (2L); Spread Spectrum Modulation - concept only (1L).

Module - 4: Information Theory & Coding: [8L]

Introduction, News value & Information content (1L); Entropy (1L); Mutual information (1L); Information rate (1L); The Shannon limit, Shanon-Fano algorithm for encoding (1L); Shannon's Theorem - Source Coding Theorem (1L); Channel Coding Theorem, Information Capacity Theorem (basic understanding only) (1L); Error Control & Coding – basic principle only (1L).

Text Books:

1. An Introduction to Analog and Digital Communications by Simon Haykin; Published by Wiley India.
2. Principles of Communication Systems, H. Taub and D. L.Schilling, TMH Publishing Co.

Reference Books :

1. Communication Systems 4th Edition by Simon Haykin; Published by Wiley India (Student Edition).
2. Communication Systems by A. B. Carlson, Published by McGraw-Hill.
3. Modern Digital and Analog Communication Systems, B.P.Lathi and Z.Ding, Oxford University Press.
4. Communications System (Analog and Digital) by Dr. Sanjay Sharma S K Kataria and Sons.

CO-PO Mapping:

COs	Program Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	-	1	1	-	-	2	-	-	3
CO2	3	3	-	3	3	-	2	-		1	2	3
CO3	3	3	3	3	2	2		-	1		-	3
CO4	3	3	3	2	3	-	2	-	-	2	2	3

Course Name: Operations Research
Course Code: CS 505A
Contact: 3:0:0

Total Contact Hours: 36

Credits: 3

Prerequisites: Basic Knowledge of Function, plotting of Equation and inequations, Formulation of Mathematical Problem. Finding maximum and minimum from row or column or from Matrix.

Course Objective: Purpose of this course to develop models and then analyze the model using the techniques of Operations Research, Decision making under uncertainty and risk.

Course Outcome(s):
On successful completion of the learning sessions of the course, the learner will be able to:

CO1: Recall the distinctive characteristics of different types of decision-making problem to formulate and solve a real-world problem a prototype of mathematical problem.

CO2: Understand the theoretical workings of appropriate decision making approaches and tools to identify the optimal strategy in competitive world.

CO3: Apply the principles of different Methods/Model of Operations Research to solve practical problems.

Course Contents:

Module I [10L]

Linear Programming Problem(LPP):Basicsof Linear Programming Problem(LPP) and its Applications. General Mathematical Formulation of LPP; Definitions: Convex set, Solution, Feasible Solution, Basic and Non-Basic Variables, Basic Feasible Solution, Degenerate and Non-Degenerate solution, Optimum/Optimal Solution; Solution of LPP by Graphical Analysis/Method, Simplex Method, Charnes' Big M-Method; Duality Theory.

Module II [6L]

Transportation Problem, Assignment Problem.

Module III [5L]

Game Theory: Introduction; Two 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

Module IV [5L]

Network Optimisation Models: CPMPERT(Arrow network),Time estimates, earliest expected time, latest allowable occurrence time, latest allowable occurrence time and stack. Critical path, Probability of meeting scheduled date of completion of project. Calculation of CPM network. Various floats for activities

Module V [2L]

Sequencing: Johnson's Algorithm (1957) For n Jobs and twomachines,n Jobs and three machines.

Module VI [5L]

Queuing Theory: Introduction and Basic Structure of Queuing Theory; Basic Definations and Notations; Birth-and-Death Model (Poisson / Exponential distribution); Poisson Queue Models: (M/M/1):(∞/FIFO) and (M/M/1):(N/FIFO) and Problems

Module VII [3L]

Inventory Control: Determination of EOQ, Components, Deterministic Continuous & Deterministic Periodic Review Models, Stochastic Continuous & Stochastic Periodic Review Models

Textbooks:

1. Operations Research by Kanti Swaroop and P.K. Man Mohan, Sultan Chand and Sons
2. Linear Programming and Theory of Games by Ghosh and Chakraborty, Central Book Agency

Reference Books:

1. Linear Programming and Theory of Games by P.M.Karak, ABS Publishing House
2. Operations Research, D.K.Jana & T.K.Roy, Chhaya Prakashani Pvt. Ltd.
3. Operations Research, Kalavati,VIKAS
4. Operations Research,Humdy A Taha,PHI / Pearson
5. Operations Research Theory and Applications by J.K.Sharma, Macmillan India Limited.

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10	P11	P12
CO1	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**
CO2	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**
CO3	**3**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**

Course Name: Computational Geometry
Course Code: CS505B
Contact: 3:0:0
Total Contact Hours: 36
Credits: 3

Prerequisites:

1. Mathematics-II
2. Algorithms &Programming Concept

Course Objective(s):

- To introduce precise algorithmic analysis for problems in Computational Geometry
- To discuss applications of Computational Geometry to graphical rendering
- To familiarize with the notions of Voronoi diagrams and Delaunay Triangulations
- To develop expected case analyses for linear programming problems in small dimensions

Course Outcome(s):

CO1 To analyse randomized algorithms for small domain problems
CO2 To use line-point duality to develop efficient algorithms
CO3 To apply geometric techniques to real-world problems in graphics
CO4: To solve linear programs geometrically

Course Contents:

Module 1: [11L]

CONVEXHULLS ALGORITHMS [5L]: Orientation test; Degeneracy; Jarvis' march, Divide & conquer; Graham's scan, Chan's algorithm

PLANE-SWEEP ALGORITHMS [6L]: Line segment intersections (Plane-sweep), Doubly linked edge list, Overlay subdivisions, Polygon Triangulation (Triangulating monotone polygons, Partitioning simple polygons), Convex Partitioning(Lower and upper bounds, A factor 4 approximation algorithm)

Module 2: [9L]

LINEAR PROGRAMMING [4L]: Manufacturing with Molds (Necessary and Sufficient condition, Half-Plane Intersections), Linear Programming (Feasible Region, Optimal solution; Incremental and randomized algorithms)

ORTHOGONAL SEARCH [5L]: Geometric data structures; Range search (Quad-tree, kd-tree), Improvements on range searching (Range tree, fractional cascading), Inverse Range Search (Segment tree, interval tree, priority search tree)

Module 3 [7L]:

VORONOI DIAGRAMS & DELAUNAY TRIANGULATIONS [9L]: Voronoi diagrams (furthest point Voronoi diagram, other distance metrics, and Fortune’s plane sweep algorithm), Delaunay triangulation (Empty circles, local Delaunay hood, edge-flip, lifting, analysis, max min angles), Randomized incremental algorithm (Incremental construction, backward analysis etc.) , Point Location (DAG structure for point

location in triangulations), Steiner triangulations (quality measure; quad-trees) , Delaunay refinement (Circum center insertion , Sphere packing argument)

Module 4: [9L]

ARRANGEMENTS [4L]: Zones (Duality, line arrangements; complexity, incremental algorithm, zone theorem), Levels and discrepancy (Super-sampling for rendering; Half-plane discrepancy)

OTHER GEOMETRY APPLICATIONS [5L]: Geometric Approximation Algorithms (TSP, Metric TSP, Euclidean TSP Polynomial Time Approximation Scheme (PTAS)), Motion Planning (Trapezoidal Maps, Robotics, Configuration Space. Connectedness, Visibility Graphs)

Textbooks:

M. de Berg, M. van Kreveld, M. Overmars, and O. Schwarzkopf. Computational Geometry: Algorithms and Applications. Springer-Verlag, 2nd edition, 2000

Reference Books:

1. Franco P. Preparata and Michael Ian Shamos, Computational geometry: An Introduction, 1 st edition, Springer-Verlag New York
2. M. Bern and D. Eppstein. Mesh generation and optimal triangulation. Computing in Euclidean Geometry (2nd ed.)
3. H. Edelsbrunner. Triangulations and meshes in computational geometry. Acta Numerica (2000), 133-213

CO-PO Mapping:

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

Course Name: Distributed Algorithms
Paper Code: CS505C
Contact: 3:0:0
Total Contact Hours: 36
Credits: 2

Prerequisites:

1. Familiarity with the basic concept of Algorithm and protocols
2. A solid background in mathematics, including probability, connective arithmetic.

Course Outcomes:

CO1: To acquire a basic concept of different models and organizational structure of distributed algorithm. To understand different models of synchronous, asynchronous allocation techniques in the light of implementation in network andmemories.

CO2: To analyze basic idealization of synchronous, asynchronous and shared allocation techniques

CO3: To explain the concepts of shared storage, data links and agreement mechanisms along with its failure detection technique foralgorithms.

CO4: To develop partial and distributed algorithms in time-based proof of protocols and methods along with its perspective in modern computing era.

Course Contents:

Module– 1:[8L]

Introduction to Distributed Algorithms, Kinds of Distributed Algorithm (**1L**); Timing Models (**1L**),

Synchronous Network Algorithms: Synchronous Network Model, (**1L**); Leader Election in a synchronous Ring (**1L**);

Algorithms in General Synchronous Networks (**1L**);

Distributed Consensus with Link Failures, Distributed Consensus with Process failures (**1L**); More Consensus problems (**2L**)

Module – 2:[5L]

Asynchronous System and network Model (2**L**); Shared Memory Algorithms and Model (**1L**); Mutual Exclusion, Resource Allocation (**1L**); Consensus; Atomic Objects(**1L**)

Module – 3: [5L]

Basic Network Algorithms(**2L**);

Synchronizers, Shared Memory versus Networks (**2L**); Logical Time, Global Snapshots and Stable properties (**1L**)

Module – 4: [11L]

Network Resource Allocation: Mutual Exclusion, General Resource Allocation (**2L**); Process Failures: Network methodology (**1L**);

Impossibility of Agreement in the presence of Faults, A Randomized Algorithm (**2L**); Failure Detectors, Approximate Agreement (**2L**);

Data Link Protocols: The Problem, Stenning'sProtocol (**2L**); Alternating Bit Protocol (**1L**);

Bounded Tag protocols tolerating Reordering, Tolerating Crashes (**1L**)

Module – 5: [7L]

Partially Synchronous Algorithms: Partially Synchronous System Models: MMT and General Timed Automata (**2L**);

Properties and Proof methods, Modeling Shared Memory and Network Systems (**2L**); Mutual Exclusion with Partial Synchrony: A single-register algorithm (**1L**);

Resilience to Timing Failures, Consensus with partial Synchrony: An Efficient algorithm (**2L**).

Text Books:

1.Joseph Jaja, "An Introduction to Parallel Algorithms", Addison Wesley

2.Nancy A. Lynch, "Distributed Algorithms", Morgan Kaufmann Publishers, 2000

Reference Books:

1. Geral Tel, "Introduction to Distributed algorithms", 2nd Edition, Cambridge,2004

2. Nicola Santoro, "Design and Analysis of Distributed Algorithms", Wiley Inter-science, John Wiley & Sons, Inc., Publication,2007.

3. A.D. Kshemkalyani, M. Singhal, "Distributed Computing: Principles, Algorithms, and Systems", Cambridge University Press, March 2011.

CO-PO Mapping:

CO&PO Mapping												
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12

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

Course Name: Computer Graphics Lab

Course Code: CS591

Contacts: 0:0:3

Credits: 1.5

Perquisites:

Knowledge of C programming language

Course Objective: To make students aware of the concepts underlying modern Computer Graphics and Machine Vision. At the end of the course the student will have the generic skills to design algorithms for digital image synthesis for a broad-based set of computing problems in various domains.

Course Outcome(s):

CO1: To draw Geometric primitives.

CO2: To execute scan line polygon filling

CO3. To implement basic transformations on objects

CO4. To implement clipping algorithm on lines

Course Contents:

1. Study of basic graphics functions defined in “graphics.h”.
2. Program for Line Drawing using DDA algorithm.
3. Program for Line Drawing using Bresenhams algorithm.
4. Program for Circle Drawing using Bresenhams algorithm.
5. Program for Ellipse Drawing using Bresenhams algorithm.

6. Programs for 2-D transformations on different objects.
7. Program for Polygon filling algorithms [Flood-Fill Algorithm].
8. Program for Polygon filling algorithms [Boundary-Fill Algorithm].
9. Program for Polygon filling algorithms [Scan Line Algorithm].
10. Programs to study window to viewport transformations
11. Program for Cohen Sutherland Line clipping algorithm.
12. Programs to study 3-D transformations in C.

Textbooks:

1. Computer Graphics C Version by Donald Hearn, M. Pauline Baker, Pearson education
2. Computer Graphics by Samit Bhattacharya, Oxford University Press.

Reference Books:

1. Schaum's outlines Computer Graphics (2nd Ed.)by Ray A. Plastock, Gordon Kalley, McGraw-Hill Inc.

2. Mathematical Elements for Computer Graphics by David Rogers, J. Alan Adams,McGraw Hill Education.

CO-PO Mapping:

CO & PO Mapping												
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	-	-	1	-	-	-	-	-	-	-
CO2	3	3	-	1	-	-	-	-	-	-	-	-
CO3	2	-	-		3	-	-	-	-	-	-	-
CO4	-	1	3	2	-	-	-	-	-	-	-	-

Course Name: Operating Systems Lab
Course Code: CS 592
Contacts: 0:0:3
Credits: 1.5
Prerequisites:

1. Computer organization
2. Computer Architecture
3. Data Structures
4. Algorithms & Programming Concept

Course Objectives:

- To familiarize the students with the Operating System.
- To demonstrate the process, memory, file and directory management issues under the UNIX/ LINUX operating system.
- To introduce LINUX basic commands.
- To make students how to make simple programs in LINUX and administrative task of LINUX

Course Outcome(s):

CO1: To Analyze different aspects of Linux.
CO2: To Create or design different scripts using shell programming.
CO3: To implement process, thread, semaphore concept of operating system.
CO4: Create shared memory with the implementation of reading from, write into shared memory.
List of Experiments:

1. **Essential Linux Commands[9P]:** Commands for files and directories cd, cp, mv, rm, mkdir, more, less, creating and viewing files, using cat, file comparisons, View files, kill, ps, who, sleep, grep, fgrep, find, sort, cal, banner, touch, file related commands – ws, sat, cut, grep etc. Mathematical commands –expr, factor, units, Pipes(use functions pipe, popen, pclose), named Pipes (FIFOs, accessing FIFO)

2. **Shell Programming [6P]:** Creating a script, making a script executable, shell syntax (variables, conditions, control structures, functions, and commands).

3. **Process [3P]**: Starting new process, replacing a process image, duplicating a process image.

4. **Semaphore [3P]:** Programming with semaphores (use functions semget, semop, semaphore_p, semaphore_v).

5. **POSIX Threads[6P]:** Programming with pthread functions(viz. pthread_create, pthread_join, pthread_exit, pthread_attr_init, pthread_cancel)

6. **Shared Memory [9P]:**Create the shared memory , Attach the shared memory segment to the address space of the calling process , Read information from the standard input and write to the shared memory, Read the content of the shared memory and write on to the standard output , Delete the shared memory

Textbooks:

Yashavant P. Kanetkar, UNIX Shell Programming, 1st edition, BPB Publications Beej's Guide to Unix IPC

Reference Books:

W. Richard Stevens, UNIX Network Programming, 2nd edition, Prentice Hall

CO-PO Mapping:

CO & PO Mapping												
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-	-	-	-	-	-	-	-	-	-	3
CO2	-	3	3	3	-	-	-	-	-	-	-	3
CO3	2	-	-	2	-	-	-	-	-	-	-	-
CO4	-	3	3	-	-	-	3	-	-	-	-	-

Course Name: DATABASE MANAGEMENT SYSTEM LAB
Course Code: CS593
Contacts: 0:0:3
Total Contact Hours: 36
Credits: 1.5

Prerequisites:

1. Logic of programming language
2. Basic concepts of data structure and algorithms

Course Objectives:

1. To learn the data models, conceptualize and depict a database system
2. To learn the fundamental concepts of SQL queries.
3. To understand the concept of designing a database with the necessary attributes.
4. To know the methodology of Accessing, Modifying and Updating data & information from the relational databases
5. To learn database design as well as to design user interface and how to connect with database.

Course Outcome(s):

On completion of the course students will be able to

CO1: Understand the basic concepts regarding database, know about query processing and techniques involved in query optimization and understand the concepts of database transaction and related database facilities including concurrency control, backup and recovery.
CO2: Understand the introductory concepts of some advanced topics in data management like distributed databases, data warehousing, deductive databases and be aware of some advanced databases like partial

multimedia and mobile databases.
CO3: Differentiate between DBMS and advanced DBMS and use of advanced database concepts and become proficient in creating database queries.
CO4: Analyze database system concepts and apply normalization to the database.
CO5: Apply and create different transaction processing and concurrency control applications.

Course Contents:
Structured Query Language
Module1: [6L]
Creating Database
Creating a Database
Creating a Table Specifying Relational Data Types
Specifying Constraints Creating Indexes

Module2: [3L]
Table and Record Handling
INSERT statement
Using SELECT and INSERT together
DELETE, UPDATE, TRUNCATE statements
DROP, ALTER statements
Module3: [6L]
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 Clause Using Aggregate Functions
Combining Tables Using JOINS
Sub-queries

Module 4: [3L]
Database Management
Creating Views
Creating Column Aliases
Creating Database Users
Using GRANT and REVOKE

Module 5:[6L]
PL/SQL
Module 6:[6L]
Database design using E-R model and Normalization
Module 7:[6L]
Design and implementation of some on line system [Library Management System]

Textbooks:

1) SQL, PL/SQL by Ivan Bayross, BPB Publications
2) Oracle PL/SQL Programming, 6th Edition - O'Reilly Media By Steven Feuerstein, Bill Pribyl

CO/PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	2	2	3	2	1	-	2	2	3	3	2	2	-
CO2	2	3	3	3	3	1	1	1	2	2	3	3	2	2	2
CO3	3	3	2	3	3	2	2	2	3	3	3	3	3	2	2
CO4	3	3	2	2	2	1	1	-	-	-	2	3	2	1	3
CO5	3	3	3	3	3	2	2	2	3	3	3	3	3	2	2

Course Name: Object Oriented Programming Lab
Course Code: CS594A
Contact: 0:0:3
Credits: 1.5

Prerequisites:

1. Computer Fundamentals
2. Basic understanding of Computer Programming and related Programming Paradigms
3. Problem Solving Techniques with proper logic Implementation.

Course Objectives:

- It demonstrates that how can you change the implementation of an object without affecting any other code by increasing data security and protecting unwanted data access. (Encapsulation).
- It allows you to have many different functions, all with the same name, all doing the same job, but depending upon different data. (Polymorphism).
- It guides you to write generic code: which will work with a range of data, so you don't have to write basic stuff over, and over again. (Generics).
- It lets you write a set of functions, then expand them in different direction without changing or copying them in any way. (Inheritance)

Course Outcome(s):

CO1: Create the procedure of communication between Objects, classes & methods.
CO2: Understand the elementary facts of Object Orientation with various characteristics as well as several aspects of Java.
CO3: Analyze distinct features of different string handling functions with various I/O operations.

CO4: Discuss simple Code Reusability notion w.r.t. Inheritance, Package and Interface.
CO5: Apply Exception handling, Multithreading and Applet (Web program in java) programming concept in Java.

Course Contents:

Module 1: Java Basics:

1. Simple Java programming using operators, control statements & loops, array.
2. Programming on class, object, and method, access specifier.
3. Programming on constructor, method/constructor overloading.
4. Programming on this keyword, call by value & call by reference, static variables & methods, inner classes.

Module 2: Basic String handling & I/O:

1. Programming to show the use of String class methods - charAt(), compareTo(), equals(), equalsIgnoreCase(), indexOf(), length() , substring(), toCharArray(), toLowerCase(), toString(), toUpperCase(), trim(), valueOf() methods.
2. Programming to show the use of StringBuffer class methods - append(), capacity(), charAt(), delete(), deleteCharAt(),ensureCapacity(), getChars(), indexOf(), insert(), length(), setCharAt(), setLength(), substring(), toString() methods.
3. Programming on Command line arguments.
4. Programming using keyboard input by implementing BufferedReader& Scanner classes.

Module 3: Inheritance, Interface and Java Packages:

1. Programming on Simple Inheritance, super and final keywords, super() method.
2. Programming on method overriding, dynamic method dispatch,abstract classes & methods, multiple inheritance by using interface.
3. Programming on importing system package, creating user-defined package, importing user-defined package, using protected access specifier, subclassing an imported class of a package, using same names for classes of different packages, adding multiple public classes to a package.

Module 4: Exception handling, Multithreading and Applet Programming:

1. Programming on exception handling using try-catch block, implementing throw and throws keywords, using finally block, creating user-defined exception.
2. Programming on creating child threads i) by extending thread class ii) by implementing runnable interface, creating child threads by assigning thread priorities.
3. Programming on creating simple applet to display some message, creating applet two add 2 integers, creating applet to do GUI based programming.

Textbooks:

1. Herbert Schildt – "Java: The Complete Reference " – 9th Ed. – TMH
2. E. Balagurusamy – " Programming With Java: A Primer " – 3rd Ed. – TMH.

Reference Books:

1. R.K Das – " Core Java for Beginners " – VIKAS PUBLISHING.
Rambaugh, James Michael, Blaha – " Object Oriented Modelling and Design " – Prentice Hall, India

CO-PO Mapping:

COs	Programme Outcomes(POs)											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	3	3	3	2	-	-	-	1	-	-	1
CO2	3	2	2	-	1	-	-	-	1	-	-	2
CO3	2	3	2	3	-	-	-	-	2	-	-	-
CO4	1	-	-	-	-	-	-	-	1	2	-	2
CO5	2	1	1	-	1	-	-	-	2	-	-	2

Course Name: Multimedia Technology Lab
Course Code: CS594B
Contacts: 0:0:3
Credits: 1.5

Perquisites: Computer Graphics Programming

Course Outcome(s):

CO1: To understand about various latest interactive multimedia devices, the basic concepts about images and image format.
CO2: To Apply and analyze data compression techniques, image compression techniques like JPEG, video compression techniques like MPEG, and the basic concepts about animation.
CO3: To evaluate and develop an interactive multimedia presentation by using multimedia devices and identify theoretical and practical aspects in designing multimedia applicationsare surrounding the emergence of multimedia technology.
CO4: To analyze the effects of scale and use on both presentation and lowerlevel requirements along with feedback evaluation in response to an objective set of criteria for multimedia design.

Course Contents:

1. Perceptual and cognitive psychology related to visual and auditory perception.

2. Methods of data sampling and digitization relative to different formats of audio and video media: frequency- and spatial-based sampling., vector-based and sampling-based media representations, audio and video files including AVI and WAV, uses and application of XML, media data compression.

3. Sound capturing & editing using tools like SOUNDFORGE
4. Image editing using tools like Adobe PhotoshopCreating/editing motion video/animation clips (using tools like Flash / Adobe Premier)

Textbooks:

1. Adobe Photoshop CC Classroom in a Book (2018 release), Pearson Ed.,
2. Anushka Wirasinha , Flash in a Flash- Web Development , PHI

Reference Books:

1. Macromedia Flash5 fast and easy Web Development, Design, PHI,
2. Lozano, Multimedia- Sound & Video , PHI

CO-PO Mapping:

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

Course Name: Communication Engineering Lab
Course Code: CS 594C
Contacts: 0:0:3

Credits: 1.5

Prerequisites: Knowledge in Electronics and Communication

Course Objective:
To provide the basic skills required to understand, develop, and design of various engineering applications involving analog and digital communication theory. To provide basic laboratory exposures for communication principles and applications.

Course outcomes:

On completion of the course students will be able to

CO1: Analyse the concept of analog and digital communication techniques and their applications.

CO2: Demonstrate to the practical methods of the use of generating and demodulating communication signals.

CO3: Distinguish the significance of signal constellation and spectral width.

CO4: Develop insight into the relations between the input and output signals in various stages of a transmitter and a receiver.

List of Experiments:

1. Measurement of modulation index of an AM signal.
2. Generation of FM using VCO chip (to view the wave shapes).
3. Study of PAM and demodulation.
4. Study of PCM and demodulation.
5. Study of ASK modulator and demodulator.
6. Study of BPSK modulator and demodulator.
7. Study of BFSK modulator and demodulator.
8. Study on QPSK modulator and demodulator.
9. One innovative experiment on bread-board realization of any one analog or digital communication circuit.

Text Books:

1. An Introduction to Analog and Digital Communications by Simon Haykin; Published by Wiley India.
2. Principles of Communication Systems, H. Taub and D .L.Schilling, TMH Publishing Co.

Reference Books:

1. Communication Systems 4th Edition by Simon Haykin; Published by Wiley India (Student Edition).
2. Communication Systems by A. B. Carlson, Published by McGraw-Hill.
3. Modern Digital and Analog Communication Systems, B.P.Lathi and Z.Ding, Oxford University Press.
4. Communications System (Analog and Digital) by Dr. Sanjay Sharma S K Kataria and Sons.

CO-PO Mapping:

COs	Programmme Outcomes (POs)											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**

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

MANDATORY COURSE

Course Name: ENVIRONMENTAL SCIENCE
Course Code: MC 501
Credits: 0
Total Lectures: 36

Course Objectives:

- Be able to understand the natural environment and its relationships with human activities.
- Be able to apply the fundamental knowledge of science and engineering to assess environmental and health risk.
- Be able to understand environmental laws and regulations to develop guidelines and procedures for health and safety issues.
- Be able to solve scientific problem-solving related to air, water, noise & land pollution.

Course Outcomes:

CO1 To understand the natural environment and its relationships with human activities.
CO2 To apply the fundamental knowledge of science and engineering to assess environmental and health risk.
CO3 To develop guidelines and procedures for health and safety issues obeying the environmental laws and regulations.
CO4 Acquire skills for scientific problem-solving related to air, water, noise & land pollution.

Course Contents:

Module 1: General [11L]

Natural Resources: Forest Resource, water resource, mineral resource, energy resources: alternative source of energy

Population Growth: Exponential Growth, logistic growth, Maximum sustainable yield, demography

Disaster Management: Types of disasters (Natural & Man-made), Floods, Earthquake, Tsunamis, Cyclones, landslides (cause, effect & control)

Ecology & Ecosystem: Elements of ecology, definition of ecosystem- components types and function, Food chain & Food web, Structure and function of the following ecosystem: Forest ecosystem, Grassland ecosystem, Desert ecosystem, Aquatic ecosystems

Environmental Management: Environmental impact assessment, Environmental laws and protection act of India(The Environment protection Act, Air pollution Act, Water Act, Wildlife Protection Act) , Hazardous waste(management and Handling) Rules.

Module 2: Air pollution and control [10L]

Sources of Pollutants: point sources, nonpoint sources and manmade sources primary & secondary pollutant

Types of air pollutants: primary & secondary pollutant ; Suspended particulate matter, oxides of carbon, oxides of nitrogen, oxides of sulphur, particulate, PAN, Smog (Photochemical smog and London smog),

Effects on human health & climate: Greenhouse effect, Global Warming, Acid rain, Ozone Layer Depletion

Air pollution and meteorology: Ambient Lapse Rate, Adiabatic Lapse Rate, Atmospheric stability & Temperature inversion control of air pollution (ESP, cyclone separator, bag house, catalytic converter, scrubber (ventury).

Module 3: Water Pollution [9L]

Classification of water (Ground & surface water)

Pollutants of water, their origin and effects: Oxygen demanding wastes, pathogens, nutrients, Salts, heavy metals, pesticides, volatile organic compounds.

Surface water quality parameters: pH, DO, 5 day BOD test, BOD reaction rate constants, COD. Numerical related to BOD

Lake: Eutrophication [Definition, source and effect].

Ground water: Aquifers, hydraulic gradient, ground water flow (Definition only),ground water pollution (Arsenic & Fluoride; sources, effects, control)

Quality of Boiler fed water: DO, hardness, alkalinity, TDS and Chloride

Layout of waste water treatment plant (scheme only).

Module 4: Land Pollution [3L]

Types of Solid Waste: Municipal, industrial, commercial, agricultural, domestic, hazardous solid wastes (bio-medical), E-waste

Solid waste disposal method: Open dumping, Land filling, incineration, composting,

recycling (Advantages and disadvantages).

Waste management: waste classification, waste segregation, treatment & disposal

Module 5: Noise Pollution [3L]

Definition of noise, effect of noise pollution on human health, Average Noise level of some common noise sources

Definition of noise frequency, noise pressure, noise intensity, noise threshold limit value, equivalent noise level, $L10$ (18 hr Index) . Noise pollution control.

Textbook:

A Textbook of Environmental Studies, Shashi Chawla. Tata McGraw Hill Education

Private Limited

References Books:

1. Environmental Studies, Dr. J P Sharma, University Science Press

2. Environmental Engineering, J K Das Mohapatra, Vikas Publication

6th Semester					
Sl. No.	**Course Code**	**Paper Code**	**Theory**	**Contact Hours /Week**	**Credit**

				L	T	P	Total	Points
1	PC	CS601	Computer Networks	3	0	0	3	3
2	PC	CS602	Microprocessors and Microcontrollers	2	1	0	3	3
3	PC	CS603	Software Engineering	3	0	0	3	3
4	PE	CS604	A. Compiler Design B. Computer Vision C. Simulation and modeling	3	0	0	3	3
5	OE	CS605	A. Pattern Recognition B. Distributed Operating System C. Distributed Database	3	0	0	3	3
6	OE	CS606	A. Data Warehousing and Data Mining B. Digital Image Processing C. E-commerce and ERP	3	0	0	3	3
Total of Theory							18	18
7	PC	CS691	Computer Networks Lab	0	0	3	3	1.5
8	PC	CS692	Microprocessors and Microcontrollers Lab	0	0	3	3	1.5
9	PC	CS693	Software Engineering Lab	0	0	3	3	1.5
10	PROJ	PR 691	Project-VI	0	0	2	2	1
11	PROJ*	PR 692	Innovative activities-V	0	0	0	0	0.5
C. MANDATORY ACTIVITIES / COURSES								
12	MC	MC 681	Technical Lecture Presentation & Group Discussion-I	3	0	0	3	
Total of Theory, Practical & Mandatory Activities/Courses							**32**	**24.0**

Course Name: Computer Networks
Course Code: CS601
Contact: 3:0:0
Total Contact Hours: 36
Credits: 3

Prerequisite:

1. Familiarity and knowledge of Operating Systems and Computer Architecture
2. Also require little bit programming languages concepts like C, Java.

Course Objective(s):

- To be familiar with the basics of data communication
- To be familiar with various types of computer networks
- To have experience in designing communication protocols
- To be exposed to the TCP/IP protocol suite

Course Outcome(s):

CO1: To understand OSI and TCP/IP models.
CO2: To analyze MAC layer protocols and LAN technologies.
CO3: To design applications using internet protocols.
CO4: To implement routing and congestion control algorithms.
CO5: To develop application layer protocols and understand socket programming.

Course Contents:

Module I: Introduction[6L]

Introduction (3L):

Introduction: Computer Network, data communication, topology, OSI & TCP/IP Reference Models, layers and characteristics, Wireless Network, comparison to wired and wireless network.

Physical Layer: [3L]

Overview of data (analog & digital), signal (analog & digital), transmission (analog & digital) & transmission media (guided & unguided); Circuit switching: time division & space division switch, TDM bus; Telephone Network;

Module II: Data Link Layer [10L]

Framing, Error Control, Error Detection and Correction, Flow Control, Data Link Protocols, Simple Stop-and-Wait Protocol, ARQ mechanism, Sliding Window Protocols, One-Bit Sliding Window Protocol, Go-Back-N and Selective Repeat, HDLC, PPP Medium Access Control Sub-layer, The Channel Allocation. **[5L]**

Multiple Access Protocols **:** ALOHA, Carrier Sense Multiple Access Protocols, IEEE 802.x Ethernet, Switched Ethernet, Fast Ethernet, Gigabit Ethernet, 10 Gigabit Ethernet, Wireless LANs - IEEE 802.xx , Bluetooth, RFID, Bridges, Virtual LANs, Switching**.[5L]**

Module III: Network Layer [10L]

IP Addressing, IPv4and IPv6. Difference IPv4and IPv6, Conversion ofIPv4and IPv6, Subnetting, Supernetting, Design Issues, Store-and-Forward Packet Switching, Virtual-Circuit and Datagram Networks, ARP, IP, ICMP, IPV6, BOOTP and DHCP–Delivery protocols Other Protocols such as mobile IP in wireless Network**.. [5L]**
Routing: Shortest Path Algorithms, Flooding, Distance Vector Routing, Link State Routing, Hierarchical Routing, Broadcast Routing, Multicast Routing, Anycast Routing, : RIP, OSPF, BGP; Routing for Mobile Hosts**. [5L]**

Module IV: Transport layer: [6L]

Process to Process delivery; UDP; TCP, SCTP, TCP RENO, TCP/IP in Wireless environment, Congestion control in TCP:Congestion Control: Open Loop, Closed Loop choke packets; Quality of service: techniques to improve QoS: Leaky bucket algorithm, Token bucket algorithm. **[5L]**
Advanced topic such as Remote Procedure Call, Delay Tolerant Networks.**[1L]**

Module V: Application Layer [3L]

Introduction to DNS, SMTP, SNMP, FTP, HTTP & WWW: Cryptography (Public, Private Key based), Digital Signature, Firewalls

Module VI: Socket Programming [1L]

Introduction to Socket Programming, UDP socket and TCP Socket

Text books:

1. B. A. Forouzan – "Data Communications and Networking (3rd Ed.) " – TMH
2. S. Tanenbaum – "Computer Networks (4th Ed.)" – Pearson Education/PHI
3. W. Stallings – "Data and Computer Communications (5th Ed.)" – PHI/ Pearson Education
4. 4. Zheng&Akhtar, Network for Computer Scientists & Engineers, OUP

Reference books:

1. Kurose and Rose – " Computer Networking -A top down approach featuring the internet" – Pearson Education
2. Leon, Garica, Widjaja – "Communication Networks" – TMH
3. Walrand – "Communication Networks" – TMH.
4. Comer – "Internetworking with TCP/IP, vol. 1, 2, 3(4th Ed.)" – Pearson Education/PHI

CO-PO Mapping:

CO	PO1	PO2	POP3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	2	-	2	-	-	-	-	2	-	-	-
CO2	-	2	-	-	-	-	-	-	2	-	-	-
CO3	2	2	-	-	2	-	-	-	2	-	-	-
CO4	2	2	-	-	2	2	-	-	2	-	-	-
CO5	3	3	-	-	3	-	-	-	2	-	-	-

Course Name: Microprocessors & Microcontrollers
Course Code: CS602
Contact: 2:1:0
Total Contact Hours: 36
Credits: 3

Prerequisite:

1. Familiarity with the number system
2. A solid background in digital logic.

Course Objective(s):

- To learn the basics of a particular microprocessor.
- To learn the basics of a particular microcontroller.
- To learn the interfacing of microprocessor.

Course Outcomes:

CO1: To acquire the knowledge of hardware details of 8085 and 8086 microprocessor AND 8051 microcontroller with the related signals and their implications.
CO2: To develop skill in assembly Language programming of 8085
CO3: To understand the concept and techniques of designing and implementing interfacing of microprocessor with memory and peripheral chips involving system design.
CO4: To analyze the performance of computers and its architecture to real-life applications

Course Contents:

Module -1: [9L]

Introduction to Microcomputer based system. [1L]
History of evolution of Microprocessor and Microcontrollers and their advantages and disadvantages. [1L]
Architecture of 8085 Microprocessor, Pin description of 8085. [2L] Address/data bus De-multiplexing, Status Signals and the control signals. [1L]
Interrupts of 8085 processor (software and hardware) [2L]
I/O Device Interfacing - I/O Mapped I/O and Memory Mapped I/O,
Memory interfacing with 8085 [2L]

Module -2: [11L]

Instruction set of 8085 microprocessor, Addressing modes. [3L]
Assembly language programming with examples, Counter and Time Delays, Stack and Subroutine. [6L]
Timing diagram of the instructions (a few examples) [2L]

Module 3: [9L]

The 8086 microprocessor- Architecture, Pin Details, Addressing modes, interrupts [4L]
Instruction set, Examples of Simple Assembly Language [3L]
Memory interfacing with 8086 [2L]

Module -4: [7L]

Introduction to 8051 Microcontroller – Architecture, Pin Details. [3L]

Addressing modes, Instruction set, Examples of Simple Assembly Language. [4L]

Text Books:

1. MICROPROCESSOR architecture, programming and Application with 8085 - R. Gaonkar (Penram international Publishing LTD.) ***[For Module 1 and 2]***
2. Fundamentals of Microprocessor and Microcontrollers - B. Ram (Paperback) ***[For Module 3]***
3. 8051 Microcontroller – K. Ayala (Cengage learning) ***[For Module 4]***

ReferenceBooks:

1. 8086 Microprocessor – K Ayala (Cengage learning)
2. The 8051 microcontroller and Embedded systems - Mazidi, Mazidi and McKinley (PEARSON)

CO-PO Mapping:

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

Course Name: Software Engineering
Course Code: CS603
Contact: 3:0:0
Total Contact Hours: 36
Credits:3

Prerequisites:

1. An understanding of basic computer software
2. Object Oriented programming skills.

Course Objective(s):

1. To develop basic Knowledge in Software Engineering and its applications.
2. To understand software Engineering layered architecture and the process frame work.
3. To analyze software process models such as the waterfall, spiral, evolutionary models and agile method for software development.
4. To design software requirements and specifications of documents.
5. To understand project planning, scheduling, cost estimation, risk management.
6. To describe data models, object models, context models and behavioral models.
7. To learn coding style and testing issues.
8. To know about the quality checking mechanism for software process and product

Course Outcomes:

CO1: To analyze, elicit and specify software requirements through a productive workingrelationship with various stakeholders of the project.
CO2: To design applicable solutions in one or more application domains using softwareengineering approaches that integrates ethical, social, legal and economic concerns.
CO3: To develop the code from the design and effectively apply relevant standards and performtesting, and quality management and practice.
CO4: To identify modern engineering tools necessary for software project management, time management and software reuse, and an ability to engage in life-long learning.

Course Contents:

Module- 1:[6L]

SoftwareEngineeringCharacteristics,Components,Application,Definitions,SoftwareProcessmodels-WaterfallModel,Prototypemodel,RAD,EvolutionaryModels,Incremental,Spiral. Agile Method SoftwareProjectPlanning- FeasibilityAnalysis,TechnicalFeasibility,CostBenefitAnalysis,COCOMO (Basic, intermediate, Complete) model

Module– 2: [3L]

SystemAnalysis:PrincipleofStructureAnalysis,RequirementAnalysis,DFD,EntityRelationship Diagram,DataDictionary,DataModeling,SoftwareRequirementsSpecification

Module – 3:[3L**]**

SoftwareDesignAspects:Objectives,Principles,Concepts,Top-DownandBottom-Updesign;Decision tree,decisiontableandstructuredEnglish,Structurechart,TransformanalysisFunctional Vs.Object-Orientedapproach

Module- 4:[4L**]**

UnifiedModelingLanguage:Classdiagram,interactiondiagram:collaborationdiagram,sequencediagr

am,statechartdiagram,activity, diagram,implementationdiagram, Use Case diagram

Module –5:[14L]

Coding&Documentation StructuredProgramming,ModularProgramming,ModuleRelationship-Coupling,Cohesion,OOP Programming,InformationHiding,Reuse,SystemDocumentation. Testing–LevelsofTesting,IntegrationTesting,SystemTesting**.** TestCases-WhiteBoxandBlackBoxtestingSoftwareQuality,QualityAssurance,SoftwareMaintenance, SoftwareConfigurationManagement,SoftwareArchitecture.

Module– 6:[6L]

Software Project Management – Project Scheduling, Staffing, Quality Assurance, Risk Management: Reactive vs. Proactive Risk strategies, software risks, Risk identification, Risk projection, Risk refinement Project Monitoring.

Textbooks:

1. SoftwareEngineering:Apractitioner'sapproach–Pressman (MH).
2. SoftwareEngineering-PankajJalote(Wiley-India)

ReferenceBooks:

1. Fundamentals of SoftwareEngineering-RajibMall(PHI).
2. SoftwareEngineering–AgarwalandAgarwal(PHI).
3. SoftwareEngineering- Sommerville (Pearson)

CO-PO Mapping:

CO &PO Mapping												
PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	3	3	3	-	-	-	-	-	-	-	-
CO2	3	3	3	3	-	-	-	-	2	-	-	-
CO3	3	2	-	3	-	-	-	-	-	-	-	-
CO4	2	2	2	-	-	-	-	1	-	-	-	-

Course Name: Compiler Design
Course Code: CS604A
Contact: 3:0:0

Total Contact Hours: 36
Credits: 3

Prerequisites:

1. Mathematics
2. Concept of programming languages
3. Data structures
4. Computer architecture
5. Formal languages and automata theory
6. Some advanced math might be required if you adventure in code optimization

Course Objectives:

To make the student understand the process involved in a compiler, create an overall view of various types of translators, linkers, loaders, and phases of a compiler, understand what is syntax analysis, various types of parsers especially the top down approach, awareness among students the various types of bottom up parsers, understand the syntax analysis and, intermediate code generation, type checking, the role of symbol table and its organization, Code generation, machine independent code optimization and instruction scheduling.

Course Outcome(s):

CO1: To illustrate the basic concept of compilers and discuss on the components as well as the strengths and weaknesses of various phases of designing a compiler.
CO2: To explain the role of finite automata in compiler design.
CO3: To design and analyze algorithms for syntactic or parsing techniques and semantic analysis of the process of designing compilers.
CO4: To formulate the theories of creating simple compilers using C programming languages.

Course Contents:

Module I [7L]

Compilers, Cousins of the Compiler, Analysis-synthesis model, The phases of the compiler.
The role of the lexical analyzer, Tokens, Patterns, Lexemes, Input buffering, Specifications of a token,

Recognition of tokens, Finite automata, From a regular expression to an NFA, From a regular expression to DFA, Design of a lexical analyzer generator (Lex).

Module II [10L]

The role of a parser, Context free grammars, Writing a grammar, Top down Parsing, Non recursive Predictive parsing (LL), Bottom up parsing, Handles, Viable prefixes, Operator precedence parsing, LR parsers (SLR, LALR, Canonical LR), Parser generators (YACC), Error Recovery strategies for different parsing techniques.

Syntax directed translation: Syntax directed definitions, Construction of syntax trees, Bottom-up evaluation of S-attributed definitions, L-attributed definitions, Bottom-up evaluation of inherited attributes.

Module III [7L]

Type systems, Specification of a simple type checker, Equivalence of type expressions, Type conversions

Source language issues (Activation trees, Control stack, scope of declaration, Binding of names), Symbol tables, dynamic storage allocation techniques.

Module IV [4L]

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

Module V [8L]

Consideration for Optimization, scope of optimization, local optimization, loop optimization, folding, DAG representation, Flow Graph, Data flow equation, global optimization, redundant sub expression elimination, induction variable elimination, copy propagation, basic blocks & flow graphs, transformation of basic blocks, DAG representation of basic blocks, peephole optimization

Object code forms, machine dependent code optimization, register allocation and assignment, generic code generation algorithms, DAG for register allocation.

Text Books:

[1] Alfred Aho, V. Ravi Sethi, D. Jeffery Ullman, “Compilers Principles, Techniques and Tools”, Addison Wesley, 2nd edition

[2] Holub Allen. Compiler Design in C, PHI, 1993.

Reference Books:

[1] Chattopadhyay, Santanu. Compiler Design. PHI Learning Pvt. Ltd., 2005

[2] Tremblay and Sorenson Compiler Writing-McgrawHill International

CO-PO Mapping:

CO & PO Mapping												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	–	–	–	–	–	–	–	–	–	–	–
CO2	3	2	–	–	–	–	–	–	–	–	–	–
CO3	–	–	3	3	–	–	–	–	–	–	–	–
CO4	–	3	–	–	–	–	–	–	–	–	–	–

Course Name: Computer Vision
Course Code: CS604B
Contact: 3:0:0
Total Contact Hours: 36
Credits: 3

Prerequisites:

No prior experience with computer vision is assumed, although previous knowledge of visual computing or signal processing will be helpful. The following skills are necessary for this class:

- Data structures
- Programming: Projects are to be completed and graded in Python. All project starter code will be in Python.
- Mathematics: Linear algebra, vector calculus, and probability.

Course Objective:

Computer Vision focuses on development of algorithms and techniques to analyze and interpret the visible world around us. This requires understanding of the fundamental concepts related to multi-dimensional signal processing, feature extraction, pattern analysis visual geometric modeling, stochastic optimization etc. Knowledge of these concepts is necessary in this field, to explore and contribute to research and further developments in the field of computer vision. Applications range from Biometrics, Medical diagnosis, document processing, mining of visual content, to surveillance, advanced rendering etc.

Course Outcomes:

CO1: To understand the Image formation process
CO2: To understand the 3D vision techniques
CO3: To extract the features form an images and accordingly analyze the Image
CO4: To develop applications using the Computer Vision Techniques
CO5: To understand the basics of video processing, motion computation and 3D vision and geometry

Course Contents:

Introduction [2L]

Introduction to Computer Vision: Low-level, Mid-level, High-level, Impact of Computer Vision, Components and its applications.

Digital Image Formation and low-level processing [5L]

Overview: Fundamentals of Image Formation, Transformation: Orthogonal, Euclidean, Affine, Projective etc. Fourier Transform, Convolution and Filtering, Light and Color and Image Filtering, Image Enhancement, Restoration, Histogram Processing.

Depth estimation and Multi-camera views [5L]

Perspective, Binocular Stereopsis: Camera and Epipolar Geometry; Image sensing, pixel arrays, CCD cameras. Image coding, Homography, Rectification, DLT, RANSAC, 3-D reconstruction framework; Auto-calibration.Apparel.

Feature Extraction [7L]

Edge detection - Canny, LOG, DOG; Line detectors (Hough Transform), Corners - Harris and Hessian Affine, Orientation Histogram, SIFT, Image preprocessing, Image representations (continuous and discrete) , Scale-Space Analysis- Image Pyramids and Gaussian derivative filters, Gabor Filters and DWT.

Image Segmentation [4L]

Contour based representation, Region based representation, Deformable curves and surfaces, Snakes and active contours, Level set representations, Fourier and wavelet descriptors, Medial representations, Multi-resolution analysis.

Pattern Analysis [7L]

Clustering: K-Means, K-Medoids, Mixture of Gaussians, Classification: Discriminant Function, Supervised, Un-supervised, Semi-supervised; Classifiers: Bayes, KNN, ANN models; Dimensionality Reduction: PCA, LDA, ICA; Non-parametric methods.

Motion Analysis [3L]

Background Subtraction and Modeling, Regularization theory, Optical computation, Stereo Vision, Motion estimation, Structure from motion.

Shape representation [3L]

Inferring 3D shape from shading; surface geometry.Boundary descriptors; codons; super-quadrics.

Text Books:

1. Szeliski, R., 2010. Computer vision: algorithms and applications. Springer Science & Business Media.

2. Forsyth, D.A. and Ponce, J., 2003. A modern approach. Computer vision: a modern approach, 17, pp.21-48.

Reference Books:

1. Hartley, R. and Zisserman, A., 2003. Multiple view geometry in computer vision.Cambridge university press.
2. Fukunaga, K., 2013. Introduction to statistical pattern recognition.Elsevier.
3. Gonzalez, R.C. and Woods, R.E., 1992. Digital image processing addison-wesley. Reading, Ma, 2.
4. Gonzalez, R.C., Woods, R.E. and Eddins, S.L., 2004. Digital image processing using MATLAB.Pearson Education India.
5. Forsyth, D.A., Mundy, J.L., diGesu, V. and Cipolla, R. eds., 2003. Shape, contour and grouping in computer vision. Springer.
6. Gruen, A. and Huang, T.S. eds., 2013. Calibration and orientation of cameras in computer vision (Vol. 34). Springer Science & Business Media.

Journals:

1. Hong, L. and Wan, Y., 1995. IEEE transactions on pattern analysis and machine intelligence. Mean shift, mode seeking, and clustering [J], 17, pp.790-799.
2. Fu, K.S., 2004. IEEE Transactions on Pattern Analysis and Machine Intelligence.Encyclopedia of Statistical Sciences.
3. Mitiche, A. and Bouthemy, P., 1996. Computation and analysis of image motion: A synopsis of current problems and methods. International journal of computer vision, 19(1), pp.29-55.
4. Uijlings, J.R., Van De Sande, K.E., Gevers, T. and Smeulders, A.W., 2013. Selective search for object recognition. International journal of computer vision, 104(2), pp.154-171.
5. Russakovsky, O., Deng, J., Su, H., Krause, J., Satheesh, S., Ma, S., Huang, Z., Karpathy, A., Khosla, A., Bernstein, M. and Berg, A.C., 2015. Imagenet large scale visual recognition challenge. International journal of computer vision, 115(3), pp.211-252.
6. Krishna, R., Zhu, Y., Groth, O., Johnson, J., Hata, K., Kravitz, J., Chen, S., Kalantidis, Y., Li, L.J., Shamma, D.A. and Bernstein, M.S., 2017. Visual genome: Connecting language and vision using crowdsourced dense image annotations. International Journal of Computer Vision, 123(1), pp.32-73.

CO-PO Mapping:

CO	PO1	PO2	POP3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	-	-	-	-	-	-	-	-	-	1
CO2	3	2	-	-	-	-	-	-	-	-	-	1
CO3	2	3	-	2	-	-	-	-	-	-	-	-
CO4	3	2	3	2	3	-	-	-	-	-	-	-
CO5	3	2	-	2	-	-	-	-	-	-	-	-

Course Name: Simulation and Modeling

Course Code: CS604C

Contact: 3:0:0

Total Contact Hours: 36
Credits: 3

Prerequisites:

- Programming and Data Structures
- Discrete Mathematics and Probability theory
- Game theory
- Numerical Analysis

Course Objective(s):

1. To understand the Models and Simulation of Continuous and Discrete Systems.
2. To enable students to analyze Continuous Uniformly Distributed Random Numbers
3. To assess the strengths and weaknesses of various methods and to analyze their behavior.

Course Outcome:

On completion of the course students will be able to

CO1: Student will be able to summarize the issues in Modeling and Simulation and to explain the System Dynamics & Probability concepts in Simulation.

CO2: Student will be able to solve the Simulation of Queuing Systems

CO3: Student will be able to analyze the Simulation output.

CO4: Student will be able to identify the application area of Modeling and Simulation, and apply them.

Course Contents:

Module-I: Introduction to Modeling and Simulation [7L]

Nature of Simulation. Systems , Models and Simulation, Continuous and Discrete Systems, system modeling, Components of a simulation study, Introduction to Static and Dynamic System simulation

, Application areas, Advantages ,Disadvantages and pitfalls of Simulation.

Module –II : System Dynamics & Probability concepts in Simulation [10L]

Exponential growth and decay models, Generalization of growth models , Discrete and Continuous probability functions, Continuous Uniformly Distributed Random Numbers, Generation of a

Random numbers, Generating Discrete distributions, Non-Uniform Continuously Distributed Random Numbers, Rejection Method.

Module-III : Simulation of Queuing Systems and Discrete System Simulation [14L]

Poisson arrival patterns, Exponential distribution, Service times, Normal Distribution Queuing Disciplines, Simulation of single and two server queue. Application of queuing theory in computer system. Discrete Events ,Generation of arrival patterns ,Simulation programming tasks
Gathering statistics, Measuring occupancy and Utilization , Recording Distributions and Transit times .

Module-IV : Analysis of Simulation output [5L]

Sensitivity Analysis, Validation of Model Results

Text Books:

1. Jerry Banks, John Carson, B.L.Nelson and D.M.Nicol ― Discrete Event System Simulation‖,

Fifth Edition, Pearson.

2. NarsinghDeo, 1979, System Simulation with Digital Computers, PHI.

Reference Books:

1. Averill M. Law and W.DavidKelton, ―Simulation Modeling and Analysis‖, Third Edition, McGraw Hill 5. J. N. Kapoor.. Mathematical Modeling, Wiley eastern Limited

2. Geoffrey Gordon, ―System Simulation‖, PHI.

CO-PO Mapping:

CO	PO1	PO2	POP3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1	-	-	1	-	-	-	-	-	-
CO2	2	3	2	2	3	-	-	-	-	-	-	-
CO3	2	2	3	1	3	1	-	-	-	-	-	-
CO4	1	3	1	1	3	1	-	-	-	-	-	-

Course Name: Pattern Recognition
Course Code: CS605A
Contact: 3:0:0
Total Contact Hours: 36
Credits: 3

Prerequisites:

- Probability theory,
- Artificial Intelligence

Course Objectives

- Understand the concept of a pattern and the basic approach to the development of pattern recognition and machine intelligence algorithms
- Understand the basic methods of feature extraction, feature evaluation, and data mining
- Understand and apply both supervised and unsupervised classification methods to detect and characterize patterns in real-world data
- Develop prototype pattern recognition algorithms that can be used to study algorithm behavior and performance against real-world multivariate data

Course Outcomes:

After the completion of four years of B.Tech, students will be able to:
CO1: Explain and compare a variety of pattern classification methods.
CO2: Analyze different clustering and classification problem and solve using different pattern recognition technique.
CO3: Apply performance evaluation methods for pattern recognition, and can do comparisons of techniques

CO4: Apply pattern recognition techniques to real-world problems such as document analysis and recognition.
CO5: Implement simple pattern classifiers, classifier combinations, and structural pattern recognizers.

Course Contents:

Module – I[4L]

Introduction[2]: The nature of statistical pattern recognition, Definitions, data sets for Pattern Recognition
Different Paradigms of Pattern Recognition [1]
Representations of Patterns and Classes [1]
Different learning paradigms, The basic structure of a pattern recognition system[2]

Module –II[6L]
Feature extraction [6]:

Feature Extraction, Feature subset selection and classification stages [2]
Dimensionality reduction: Principal component analysis, Fisher discriminant analysis, Factor Analysis[4]

Module –III[13L]

Different Approaches to Prototype Selection [2]
Nearest Neighbour Classifier and variants [2]
Bayes Classifier [3]
Decision Trees [3]
Linear Discriminant Function [3]

Module – IV[13L]

Support Vector Machines [2]
Clustering [3]
Clustering Large datasets [3]
Combination of Classifiers [3]
Applications - Document Recognition [2]

Text Books:

1. R.O.Duda, P.E.Hart and D.G.Stork, Pattern Classification, John Wiley, 2001
2. Devi V.S.; Murty, M.N. (2011) Pattern Recognition: An Introduction, Universities Press, Hyderabad.

Reference books:

1. S.Theodoridis and K.Koutroumbas, Pattern Recognition, 4th Ed., Academic Press, 2009
2. C.M.Bishop, Pattern Recognition and Machine Learning, Springer, 2006

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-	-	3	-	-	-	-	-	-	-	2
CO2	3	3	-	-	-	-	-	-	-	-	-	-
CO3	-	3	-	-	-	2	-	-	-	-	-	-
CO4	2	-	-	3	-	-	3	-	-	-	-	-
CO5	3	-	-	2	3	-	1	-	-	-	-	3

Course Name: Distributed Operating system
Course Code: CS605B
Contact: 3:0:0
Total Contact Hours: 36
Credits: 3

Prerequisites:

1. Have to knowledge about Computer Network, operating system and Computer architecture.
2. Required C and UNIX knowledge.

Course Objective(s):

This course covers general issues of design and implementation of distributed operating systems. The focus is on issues that are critical to the applications of distributed systems and computer networks, which include inter-process communication, distributed processing, sharing and replication of data and files.

Course Outcome(s):

CO1: To understandings outline the potential benefits of distributed systems and major security issues associated with distributed system.

CO2: To understand and analyze Distributed Computing techniques, Synchronous and Processes and Apply Shared Data access and Files concepts.
CO3: To understand Distributed File Systems and Distributed Shared Memory
CO4: To apply standard design principles in the construction of these systems.

Course Contents:

Module I [6L]

Functions of an Operating System, Design Approaches, Review of Network Operating System and Distributed Operating System, Issue in the design of Distributed Operating System, Overview of Computer Networks, Modes of communication, System Process, Interrupt Handling, Handling Systems calls, Protection of resources, Micro-Kernel Operating System, client server architecture.

Module II [8L]

The Critical Section Problem, Other Synchronization Problems, Language Mechanisms for Synchronization, Axiomatic Verification of Parallel Programs, Inter process communication (Linux IPC Mechanism), Remote Procedure calls, RPC exception handling, security issues, RPC in Heterogeneous Environment, Case studies.

Module III [8L]

Clocks: Logical clocks, Physical clocks, Vector Clock, clock synchronization algorithms, Mutual Exclusion, Non-Token Based Algorithms – Lamppost's Algorithm, Token-Based Algorithms, Suzuki-Kasami's Broadcast Algorithm, Election Algorithms-Bully algo etc, Dead locks in Distributed Systems, Thrashing, Resource Management (Load Balancing approach, Load Sharing approach), Process Management, process Migration, Thread, and Case studies.

Module IV [8L]

Overview of shared memory, Architecture, Algorithm, Protocols, Design Issues, consistency model, Page based Distributed Shared Memory, Shared variable Distributed shared Memory, and Object based Distributed shared Memory, Heterogeneous DSM, Distributed Scheduling, Issues, Components, Algorithms Case studies.

Module V [6L]

File models, File access, File sharing, file-caching, File Replication, Features of Naming system terminologies and concepts of naming, fault Tolerance, Network File System (case study), 8NFS on Linux Directory Services, Security in Distributed File system, Tools (Cuda, , Amazon AWS,

OpenStack, Cilk, gdb, threads, OpenMP, Hadoop), Case studies

Textbooks:

1. P.K. Sinha Distributed Operating system (Willey publication)
2. M. Beck et al Linux Kernel, Internal Addition Wesley, 1997.

Reference Books:

1. T. L. Casavant and M. Singhal, Distributed Computing Systems, IEEE Computer Society Press (1994) ISBN 0-8186-3032-9
2. R. Chow and T. Johnson, Distributed Operating Systems & Algorithms, Addison-Wesley (1997) ISBN 0-201-49838-3
3. G. Coulouris, J. Dollimore, and T. Kindberg, Distributed Systems: Concepts & Design, 3rd edition, Addison-Wesley (2001) ISBN 0-201-61918-0
4. D. L. Galli, Distributed Operating Systems, Prentice-Hall (2000) ISBN 0-13-079843-6
5. C. Leopold, Parallel and Distributed Computing, John Wiley & Sons (2001) ISBN 0-471- 35831-2
6. G. J. Nutt, Centralized and Distributed Operating Systems, Prentice-Hall (1992) ISBN 0-201-61251-8
7. M. Raynal, M. Beeson, trans., Algorithms for Mutual Exclusion, MIT Press (1986) ISBN 0- 262-18119-3
8. M. Raynal, J. Howlett, trans., Distributed Algorithms and Protocols, J. Howlett, trans., Wiley & Sons (1988) ISBN 0-471-91754-0
9. B.W. Kernighan and R Pide, the UNIX Programming Environment Prentice Hall of India- 2000
10. Asilberschatz P.B Garvin Operating System Concept, John Wiley & Sons (Asia) Pte 2000.
11. Cox K, “Red Hat Linux Administrator’s Guide”. PHI (200)

CO-PO Mapping:

CO	PO1	PO2	POP3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	2	2	2	-	-	-	-	-	-	-	-
CO2	-	3	3	-	-	-	-	-	-	-	-	-
CO3	2	2	3	2	-	-	-	-	-	-	-	-
CO4	2	2	3	2	-	-	-	-	-	-	-	-

Course Name: Distributed Database
Course Code: CS605C
Contact: 3:0:0
Contact Hours: 36
Credits: 3

Prerequisites:

1. Good knowledge in Database ManagementSystem.
2. Determination to learn new and difficultthings.

Course Objective(s):

- To learn the principal and foundation of distributeddatabase.
- To learn the architecture, design issue and integrity control of distributeddatabase.
- To learn the details of query processing and query optimizationtechnique.
- To learn the concept of transaction management in distributeddatabase.

Course Outcome(s):

On completion of the course students will be able to
CO1: Describe database management system internals, understand and describe internal algorithms in detail.
CO2: Identify and be able to use recent and advanced database techniques (e.g. in concurrency control, buffer management, and recovery
CO3: Decide on configuration issues related to database operation and performance. Identify which parameters are suitable and what are its implications
CO4: Analyze and optimize transactional code, identifying causes of possible anomalies and correct them.
CO5: Decide on optimization issues given a known database workload, by manipulating indexes, choosing more adequate data types, and modifying queries.

Course Contents:

Module I: [9L]

Introductory concepts and design of (DDBMS)

Data Fragmentation; Replication; and allocation techniques for DDBMS; Methods for designing and implementing DDBMS, designing a distributed relational database; Architectures for DDBMS: cluster federated, parallel databases and client server architecture.

Module II: [9L]

QueryProcessing [4L]

Overview of Query Processing: Query processing problem; Objectives of Query Processing; Complexity of Relational Algebra operations; characterization of Query processors; Layers of Query Processing; Translation of global queries.

Transaction Management [5L]

Introduction to Transaction Management: Definition of Transaction, Properties of Transaction, types of transaction; Distributed Concurrency Control: Serializability theory; Taxonomy of concurrency control mechanisms; locking bases concurrency control algorithms.

Module III: [5L]

Partitioned network; check point and cold start; Management of distributed transaction; Architectural aspect; Node and link failure recoveries

Module IV: [3L]

Distributed data dictionary management.Distributed database administration. Heterogeneous databases- federated database, reference architecture, loosely and tightly coupled.

Module V: [5L]

Distributed Object Database Management systems [5L]

Fundamental Object concepts and Object models; Object distribution design; Architectural issues; Object management; Distributed object storage; Object query processing

Module IV: [5L]

Current trends & developments related to Distributed database applications technologies [5L]

Distributed Object/component-based DBMS; Database Interoperability including CORBA; DCOM and Java RMI;Distributed document-based systems; XML and Workflow management.

Text books:

1. Distributed Databases - Principles and Systems; Stefano Ceri; GuiseppePelagatti; Tata McGraw Hill; 1985.
2. Fundamental of Database Systems; Elmasri&Navathe; Pearson Education;Asia

Reference books:

1. Database System Concepts; Korth&Sudarshan;TMH
2. Principles of Distributed Database Systems; M. Tamer Özsu; and Patrick Valduriez PrenticeHall

CO-PO Mapping:

CO#	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	2	2	3	1	-	-	-	2	2	3	2	3	2	2
CO2	1	2	3	2	-	-	-	-	-	-	2	2	2	2	2
CO3	2	3	2	2	1	-	-	-	-	-	-	1	2	1	2
CO4	2	3	2	2	2	-	-	-	-	-	-	1	2	2	2
CO5	2	3	2	2	2	-	-	-	-	-	2	2	2	2	1

Course Name: Data Warehousing & Data Mining
Course Code: CS606A
Contact: 3:0:0
Contact Hours: 36
Credits: 3

Perquisites:

Programming and Data Structures, Database Management System

Course Objective(s):

1. To understand classical models and algorithms in data warehousing and data mining.
2. To enable students to analyze the data, identify the problems, and choose the relevant models and algorithms to apply.
3. To assess the strengths and weaknesses of various methods and algorithms and to analyze their behavior.

Course Outcome(s):

On completion of the course students will be able to
CO1: Student will be able to summarize the issues in Data mining.
CO2: Student will be able to explain and give examples of Data warehousing.
CO3: Student will be able to solve Business problems and can apply the Data mining in real applications in industry.
CO4: Student will also be able to implement the classical algorithms in data mining and data warehousing.

Course Contents:

Module I: Introduction to Data Warehousing [8L]

Data Warehousing: Data warehouse Architecture and Infrastructure , Data warehousing Components –Building a Data warehouse –- Mapping the Data Warehouse to a Multiprocessor Architecture – DBMS Schemas for Decision Support –Data Extraction, Cleanup, and Transformation Tools – Metadata.

Module II: Business Analysis [5L]

Business Analysis: Reporting and Query tools and Applications – Tool Categories – The Need for Applications – Cognos Impromptu – Online Analytical Processing (OLAP) – Need – Multidimensional Data Model – OLAP Guidelines – Multidimensional versus Multirelational OLAP – Categories of Tools – OLAP Tools and the Internet.

Module III: Data Mining and Classification [12L]

Data Mining: Introduction – Data – Types of Data – Data Mining Functionalities – Interestingness of Patterns – Classification of Data Mining Systems – Data Mining Task Primitives –Integration of a Data Mining System with a Data Warehouse – Issues –Data Preprocessing.
Association Rule Mining and Classification: Mining Frequent Patterns, Associations and Correlations – Mining Methods – Mining Various Kinds of Association Rules – Correlation Analysis

– Constraint Based Association Mining – Classification and Prediction - Basic Concepts - Decision Tree Induction – Bayesian Classification – Rule Based Classification – Classification by Backpropagation – Support Vector Machines – Associative Classification – Lazy Learners – Other Classification Methods – Prediction.

Module IV: Clustering and Applications [11L]

Clustering and Applications and Trends in Data Mining: Cluster Analysis - Types of Data – Categorization of Major Clustering Methods – Kmeans – Partitioning Methods – Hierarchical Methods - Density-Based Methods –Grid Based Methods – Model-Based Clustering Methods – Clustering High Dimensional Data - Constraint – Based Cluster Analysis – Outlier Analysis – Data Mining Applications.

Text Books:

1. Jiawei Han and MichelineKamber, “Data Mining Concepts and Techniques”, Second Edition, Elsevier, 2007.

2.Pang-Ning Tan, Michael Steinbach and Vipin Kumar, " Introduction To Data Mining",Person Education, 2007.

Reference Books:

1. Daniel T.Larose, "Data Mining Methods and Models", Wile-Interscience, 2006.
2. Margaret H. Dunham, "Data Mining: Introductory and Advanced Topics", Prentice Hall, 2003.CO-PO Mapping:

CO-PO Mapping												
PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-	-	-	-	1	-	-	-	-	-	2
CO2	3	2	1	-	-	-	-	-	-	-	-	3
CO3	2	3	2	2	-	2	2	2	-	-	-	3
CO4	2	2	3	1	1	1	-	-	-	-	-	2

Course Name: Digital Image Processing
Course Code: CS606B
Contact: 3:0:0
Total Contact Hours: 36
Credits: 3

Prerequisite:

1. Fourier analysis
2. Linear algebra
3. Probability

Course Objective(s)

- To learn discrete Fourier transform and its properties
- To study the monochrome and color image fundamentals
- To learn the analytical tools and methods which are currently used in digital image processing as applied to image information for human viewing.
- To learn image compression and segmentation techniques.

Course Outcome(s):

CO1: To acquire the knowledge of basic preprocessing techniques in monochrome and color images.
CO2: To develop skill in concepts of image enhancement like linear and non linear spatial filters using MATLAB.
CO3: To understand the concept and techniques of simple image processing projects using different methods of restoration.
CO4: To acquire the knowledge of the various segmentation algorithms for practical applications.
CO5: To analyze the performance of Lossless and Lossy compression techniques in images.

Course Contents:

Module -1: Introduction:[5L]

Digital Image Fundamentals **:** Overview, Computer imaging systems , Digital Image Representation, Fundamental steps in Image Processing **[1L]**, Elements of Digital Image Processing - Image Acquisition, Storage, Processing, Communication, Display **[1L]**. Digital Image Formation: A Simple Image Model, Use and Analysis of Color Models in Image Processing **[2L]**, Sampling & Quantization - Uniform & Non-uniform **[1L]**.

Module -2: Mathematical Preliminaries : [5L]

Neighbour of pixels, Connectivity, Relations, Equivalence & Transitive Closure **[1L]**; Distance Measures, Arithmetic/Logic Operations, Discrete Signals and Systems **[1L]**- A Review – Fourier Transformation, Properties of The Two Dimensional Fourier Transform **[2L]**, Discrete Fourier Transform, Discrete Cosine & Sine Transform **[1L]**.

Module 3: Image Enhancement : [6L]

Spatial Domain: Gray level transformations – Histogram processing **[2L]** Basics of Spatial Filtering– Smoothing and Sharpening Spatial Filtering – Frequency Domain **[2L]**– Smoothing and Sharpening frequency domain filters – Ideal, Butterworth and Gaussian filters **[2L]**.

Module -4: Image Restoration, Segmentation and Filtering :[14L]

Image Restoration and Segmentation:Image restoration: noise removal: mean & adaptive filters, degradation model, inverse filter **[2L]**. Discrete Formulation, Algebraic Approach to RestorationUnconstrained & Constrained **[1L]**; Constrained Least Square Restoration, Restoration by Homomorphic Filtering **[1L]**, Geometric Transformation - Spatial Transformation, Gray Level Interpolation **[1L]**. Image Segmentation : Point Detection, Line Detection, Edge detection, Combined detection **[2L]**,

Module -5: Edge Linking, Boundary Detection and Image compression : [5L]

Edge Linking & Boundary Detection- Local Processing, Global Processing via The Hough Transform **[2L]**; Thresholding - Foundation, Simple Global Thresholding, Optimal Thresholding**[2L]**; Region Oriented Segmentation - Basic Formulation, Region Growing by PixelAggregation, Region Splitting & Merging **[2L]**.
Image compression: system model, lossless methods ,lossy methods [2L]

Module -6: Image Representation and Recognition :**[5L]**

Image Representation and Recognition :Boundary representation – Chain Code – Polygonal approximation **[1L]**, signature, boundary segments – Boundary description **[1L]** – Shape number- Fourier Descriptor **[1L]**, moments- Regional Descriptors –Topological feature **[1L]**, Texture – Patterns and Pattern classes – Recognition based on matching **[1L]**.

Text Books:

1. Chanda&Majumder , Digital Image Processing & Analysis, PHI

Reference books:

1. Malay K. Pakhira, Digital Image Processing and Pattern Recognition, First Edition, PHI Learning Pvt. Ltd., 2011.

2. Rafael C. Gonzales and Richard E. Woods, Digital Image Processing, Third Edition, Pearson Education, 2010.

CO-PO Mapping:

CO-PO Mapping												
CO \ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-	-	-	-	1	1	-	-	-	-	-
CO2	-	1	2	1	-	-	-	-	-	-	-	1
CO3	1	2	-	2	2	-	-	-	1	-	-	-
CO4	2	-	-	-	-	2	2	-	-	1	1	-
CO5	-	3	-	1	-	3	-	1	-	-	-	-

Course Name: E-commerce and ERP
Course Code: CS606C
Contact: 3:0:0
Total Contact Hours: 36
Credits: 3

Perquisites: Knowledge of basic and Networking

Course Objective(s)

- To impart knowledge on E-Commerce & ERP and its various applications.
- To understand E-Commerce framework and business model applications of E-Commerce
- To understand e-payment mechanisms

Course Outcome(s)

On completion of the course students will be able to
CO1: To define and differentiate various types of Ecommerce.
CO2: To define and describe E-business and its Models.
CO3: To describe Hardware and Software Technologies for Ecommerce.
CO4: To understand the basic concepts of ERP and identify different technologies used in ERP.
CO5: To apply different tools used in ERP

Course Contents:

Module 1: Overview of E-Commerce [10L]

Introduction to E-Commerce [4L]: Definition, Scope of E-Commerce, Hardware requirements, E-Commerce and Trade Cycle, Electronic Markets, Electronic Data Interchange and Internet Commerce.
Business to Business E-Commerce [6L]: Business Models of e–commerce: Model Based On Transaction Type, Model Based On Transaction Party - B2B, B2C, C2B, C2C, E – Governance.Electronic Markets, Electronic Data Interchange (EDI): Technology, Standards (UN/EDIFACT), Communications, Implementations, Agreements, Security, EDI and Business, Inter- Organizational E-commerce.

Module 2: Security Issues in E-Commerce [10L]

Legal issues [4L]: Risks: Paper Document vs. Electronic document, Authentication of Electronic document, Laws, Legal issues for Internet Commerce: Trademarks and Domain names, Copyright, Jurisdiction issues, Service provider liability, Enforceable online contract.

Security Issues [6L]:

Risk of E – Commerce: Overview, Security for E – Commerce, Security Standards, Firewall, Cryptography, Key Management, Password Systems
Security Solutions: Symmetric and Asymmetric Cryptosystems, RSA, DES, and Digital Signature, Protocols for secure messaging, Secure Electronic Transaction (SET) Protocol, Electronic cash over

internet, Internet Security.

Module 3: Applications [2L]

E-business [2L]: **Internet bookshops, Software supplies and support, Electronic Newspapers, Internet Banking, Virtual Auctions, Online Share Dealing, Gambling on the net, E-Diversity, Case studies through internet.**

Module 4: Overview of ERP (7L)

The evolution of ERP systems: A historical perspective [3L]

Evolution through Payroll system, Inventory Control system, Materials Requirement Planning (MRP I) system, Manufacturing Resource Planning (MRP II) system, their advantages and disadvantages. Definition and Concept of ERP, Business reasons for rise and popularity of ERP system - Benefits of an ERP system

Business processes supported by ERP systems [4L]

Various business functions in an Organization – Purchasing, Materials Management, Manufacturing, Sales & Distribution, Plant Maintenance, Quality Management, Finance & Accounting including Costing, Human Resources etc.

ERP market place – SAP, Oracle, PeopleSoft, JD Edwards, Baan, Microsoft's suit of products etc. Business modules in these ERP packages – a brief comparative description of business function modules and sub-modules.

Overview of key end-to-end business processes supported in two major ERP systems (preferably SAP and Oracle) – Order to Cash, Procure to Pay, Plan to Produce and Despatch.

Module 5 : Emerging Trends and Future of ERP systems

(7L) Emerging Technologies and ERP [5L]

Service-oriented Architecture (SOA): Enterprise SOA layers – Business processes, Business services, Difference between multi-layered Client-server architecture and SOA, basic awareness of NetWeaver from SAP, Websphere from Oracle and .Net from Microsoft. Enterprise Application Integration (EAI): Basic understanding of the concept, Types of EAI (levels) – User Interface, Method (logic), Application Interface, Data.

Radio Frequency Identification (RFID) and ERP: awareness of RFID technology, Benefits of RFID integrated with ERPs.

M-Commerce: basic concept and applications, difference with E-Commerce, benefits of integration with ERPs.

Future of ERP Technology [2L]

Enterprise Application Integration (EAI), ERP and E-Commerce, ERP and Internet, Growing mobile applications, Economical and Easy models of ERP deployment etc.

Text books:

1. E-Commerce-Strategy, Technologies & Applications by David Whitley, TMH

2. Enterprise Resource Planning – A Managerial Perspective by D P Goyal, Tata McGraw Hill Education

Recommended books:

1. E-Commerce- The cutting edge of business by Kamlesh K. Bajaj, TMH

2. Global Electronic Commerce- Theory and Case Studies by J. Christopher Westland and Theodore H. K Clark, University Press

3. Enterprise Resource Planning by Ashim Raj Singla, Cengage Learning

4. E-Commerce,M.M. Oka, EPH

5. Kalakotia, Whinston : Frontiers of Electronic Commerce , Pearson Education.

CO-PO Mapping:

CO & PO Mapping												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	3	1	-	-	1	-	3	3	3	1
CO2	2	2	3	3	2	2	-	-	2	3	1	3
CO3	3	3	2	2	2	1	1	-	3	2	1	3
CO4	3	2	2	2	2	3	-	-	3	3	2	1
CO5	3	2	1	3	2	3	-	-	3	3	3	3

Course Name: Computer Networks Lab
Course Code: CS691
Contact: 0:0:3
Credit Point: 1.5

Prerequisites:

1. Familiarity and knowledge of Computer Network and Computer Architecture
2. Also require strong knowledge of programming languages like C, Java and UNIX or Linux environment.

Course Outcome(s):

CO1: Demonstrate the socket program using TCP & UDP.
CO2: Develop simple applications using TCP & UDP.

CO3: Develop the code for Data link layer protocol simulation.
CO4: Examine the performances of Routing protocol.
CO5: Experiment with congestion control algorithm using network simulator

Course Contents:

- Familiarization of UNIX or Linux environment, UNIX or Linux general Commandsspecially Network Commands. Familiarization of Internetworking - Network Cables - Color coding - Crimping. Internetworking Operating Systems - Configurations. **[6L]**
- Socket Programming using TCP and UDP **[18L]**
- Implementing routing protocols such as RIP, OSPF. **[2L]**

- Familiarization of advanced simulators like Packet Tracer, NS2/NS3, OMNET++, TinyOS**[4L]**
- Server Configuration: only web server (If time permit..instructor can do more than that) **[6L]**

Text books:

1. TCP sockets in C programs-Practical guide for Programmers ByMicheal J Donahoo and Kenneth L calvert.
2. Socket Programming by rajkumarBuyaa.

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	2	3	2	1		3	2	2	3
CO2	3	3	3	2	3	3	2	3	3	2	2	3
CO3	3	3	3	2	2	1	2	1	3	2	2	3
CO4	3	3	3	1	2	2	1	3	3	2	2	3
CO5	3	3	3	2	2	2	1	2	3	2	2	3

Course Name: Microprocessors & Microcontrollers Lab

Course Code: CS692

Contact: 0:0:3

Credits: 1.5

Prerequisites:

1. Familiarity with the number system
2. A solid background in digital logic and implementation of digital circuit in a bread board.

Course Objective(s)

- To learn the assembly language programming of a microprocessor.
- To learn the assembly language programming of a microcontroller.
- To learn the interfacing of microprocessor.
- To be familiar with microprocessor and microcontroller based projects.

Course Outcome(s):

CO1: To understand and apply the fundamentals of assembly level programming of microprocessors and microcontroller
CO2: To work with standard microprocessor real time interfaces including GPIO, serial ports, digital-to-analog converters and analog-to-digital converters.
CO3: To troubleshoot interactions between software and hardware**.**
CO4: To analyze abstract problems and apply a combination of hardware and software to address the problem

Course Contents:

Module -1: [3L]

Study of Prewritten programs on 8085 trainer kit using the basic instruction set (data transfer,Load/Store, Arithmetic, Logical).
Or,
Familiarization with 8085 simulator on PC.
Programs using basic instruction set (data transfer,Load/Store, Arithmetic, Logical) on the simulator.

Module -2: [24L]
Programming using kit or Simulator for:

1. Table look up
2. Copying a block of memory
3. Shifting a block of memory
4. Packing and unpacking of BCD numbers
5. Addition of BCD numbers
6. Binary to ASCII conversion and vice-versa (Using Subroutine Call)
7. BCD to Binary Conversion and vice-versa
8. HCF of two numbers
9. Addition of numbers using subroutine
10. Clearing the flag register

Module -3: [3L]

Study of Prewritten programs on 8051 Microcontroller Kit using the basic instruction set (datatransfer, Load/Store, Arithmetic, Logical).

Or,

Familiarization with 8051 Simulator on PC.
Study of prewritten programs using basic instruction set (data transfer, Load/Store, Arithmetic, Logical).

Text Books:

1. MICROPROCESSOR architecture, programming and Application with 8085 - R.Gaonkar (Penram international Publishing LTD.)
2. Fundamentals of Microprocessor and Microcontrollers - B. Ram (Paperback)
3. 8051 Microcontroller – K. Ayala (Cengage learning)

Reference books:

1. The 8051 microcontroller and Embedded systems - Mazidi, Mazidi and McKinley (PEARSON)

CO-PO Mapping:

	CO & PO Mapping											
	PO1	PO2	POP3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	–	–	–	–	–	–	–	–	–	–
CO2	–	–	2	–	–	–	–	–	–	–	–	–
CO3	1	–	2	–	–	–	–	–	–	–	–	–
CO4	2	3	–	–	–	–	–	–	–	–	–	–

Course Name: Software Engineering Lab
Course Code: CS693
Contact: 0:0:3
Credits: 1.5

Prerequisites:

For Software Engineering Lab, design a project proposal which will be used throughout the lab for performing different experiments using CASE Tools.

Course Outcome(s):

CO1: To handle software development models through rational method.
CO2: To prepare SRS document, design document, project management related document.
CO3: To develop function oriented and object-oriented software design using tools like rational rose.
CO4: To apply various testing techniques through test cases.

Course Contents:
Assignments to be given as following:

1. Preparation of requirement document for standard application problems in standard format. (e.g. Library Management System, Railway Reservation system, Hospital management System, University Admission system).
2. Project Schedule preparation. Software Requirement Analysis: Describe the individual Phases/ modules of the project, Identify deliverables, and draw DFD
3. Use Case diagram, Class Diagram, Sequence Diagram, Activity Diagramand prepare Software Design Document using tools like Rational Rose. (For standard application problems)
4. Software Development and Debugging. Estimation of project size using Function Point (FP) for calculation.
5. Design Test Cases/Test Plan (both Black box and White Box approach)

6. Compute Process and Product Metrics (e.g. Defect Density,DefectAge,Productivity,Cost etc.) Cost Estimation models. COCOMO

CO-PO Mapping:

CO & PO Mapping												
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	3	3	-	-	-	-	-	-	-	-
CO2	3	3	3	2	-	-	-	-	-	2	-	-
CO3	3	2	-	3	-	-	-	-	-	-	1	-
CO4	2	2	2	-	-	-	-	1	-	-	-	-

7th Semester								
Sl. No.	**Course Code**	**Paper Code**	**Theory**	**Contact Hours/Week**				**Credit points**
				L	T	P	Total	
A.Theory								
1	HS	HU701	Values & Ethics in Profession	2	0	0	2	2
2	OE	CS701	A. Artificial Intelligence B. Robotics C. Data Analytics	3	0	0	3	3
3	PE	CS702	A. Soft Computing B. Natural Language Processing C. Web Technology	3	0	0	3	3
4	PE	CS703	A. Cloud Computing B. Sensor Network and IOT C. Cryptography and Network Security	3	0	0	3	3
Total No of Theory							11	11
B. PRACTICAL								
5	OE	CS791	A. Artificial Intelligence Lab B. Robotics Lab C. Data Analytics Lab	0	0	3	3	1.5
6	PE	CS792	A. Soft Computing Lab B. Natural Language Processing Lab C. Web Technology Lab	0	0	3	3	1.5
7	PROJ	PR 791	Project-VII	0	0	0	6	3
8	PROJ*	PR 792	Innovative activities-VI	0	0	0	0	0.5
C. MANDATORY ACTIVITIES / COURSES								
9	MC	MC781	Social Awareness	0	0	3	3	
Total of Theory, Practical & Mandatory Activities/Courses							26	17.5

Paper Name: Values and Ethics in Profession
Paper Code: HU702
Contact: L-T-P= 2-0-0
Credit: 2

Prerequisites:
Basic knowledge of communication, Knowledge about environment science

Course Objective:
To create awareness on professional ethics and Human Values

Course Outcome(s):
CO1 To understand the core values that shape the ethical behavior of an engineer and Exposed awareness on professional ethics and human values.
CO2 To understand the basic perception of profession, professional ethics, various moral issues & uses of ethical theories.
CO3 To understand various social issues, industrial standards, code of ethics and role of professional ethics in engineering field.
CO4 To aware of responsibilities of an engineer for safety and risk benefit analysis, professional rights and responsibilities of an engineer.
CO5 To acquire knowledge about various roles of engineers in variety of global issues and able to apply ethical principles to resolve situations that arise in their professional lives

Course contents:

Module: 1 Introduction: Definition of Ethics; Approaches to Ethics: Psychological, Philosophical, Social.

Module: **2 Psycho-social theories of moral development**: View of Kohlberg; Morality and Ideology, Culture and Morality, Morality in everyday Context.

Module: **3 Ethical Concerns**: Work Ethics and Work Values, Business Ethics, Human values in organizations: Values Crisis in contemporary society Nature of values: Value Spectrum of a good life.

Module: 4 Ethics of Profession:
Engineering profession: Ethical issues in Engineering practice, Conflicts between business demands and professional ideals.
Social and ethical responsibilities of Technologists. Codes of professional ethics. Whistle blowing and beyond, Case studies.

Module: 5 Self Development: Character strengths and virtues, Emotional Intelligence, Social intelligence, Positive cognitive states and processes (Self-efficacy, Empathy, Gratitude, Compassion, and Forgiveness).

Module: 6 Effects of Technological Growth:
Rapid Technological growth and depletion of resources, Reports of the Club of Rome. Limits of growth: sustainable development Energy Crisis: Renewable Energy Resources, Environmental

degradation and pollution. Eco-friendly Technologies. Environmental Regulations, Environmental Ethics
Appropriate Technology, Movement of Schumacher; Problems of man, machine, interaction.

Text / Reference Books:

1. Stephen H Unger, Controlling Technology: Ethics and the Responsible Engineers, John Wiley & Sons, New York 1994 (2nd Ed)
2. Deborah Johnson, Ethical Issues in Engineering, Prentice Hall, Englewood Cliffs, New Jersey 1991.
3. A N Tripathi, Human values in the Engineering Profession, Monograph published by IIM, Calcutta 1996.

Name of the Paper: Artificial Intelligence
Paper Code: CS701A
Contact (Periods/Week):=3L/Week
Credit Point: 3
No. of Lectures: 36

Prerequisite:

1. Basics of Design and Analysis of Algorithm
2. A solid background in mathematics, including probability.

Course Objective(s):

- To learn the overview of artificial intelligence principles and approaches.
- To develop a basic understanding of the building blocks of AI as presented in terms of intelligent agents.
- This course also covers fundamental areas of Local Search Algorithms, Adversarial Searching and Neural Networks.

Course Outcome(s):
On completion of the course students will be able to
CO1 To know the fundamental concepts of Artificial Intelligence such as knowledge representation, problem solving and expert systems.
CO2 To know the use of AI to solve communication problems using Natural Language Processing
CO3 To develop knowledge of decision making and learning methods.
CO4 To develop new facts from existing knowledge base using resolution and unification.
CO5 To demonstrate the way of writing Facts and Rules in order to solve some problems based on rules and to develop systems for question-answer.

Course contents:

Module 1: Basics of AI [7L]:
Introduction [2]
Overview of Artificial intelligence- Problems of AI, AI technique, Tic - Tac - Toe problem.
Intelligent Agents [2]

Agents & environment, nature of environment, structure of agents, goal based agents, utility based agents, learning agents.

Learning [3]

Forms of learning, inductive learning, learning decision trees, explanation based learning, learning using relevance information, neural net learning & genetic learning.

Module 2: Different types of searching algorithms [14L] Problem Solving [3]

Problems, Problem Space & search: Defining the problem as state space search, production system, constraint satisfaction problems, issues in the design of search programs.

Search techniques [4]

Solving problems by searching: Problem solving agents, searching for solutions; uniform search strategies: breadth first search, depth first search, depth limited search, bidirectional search, comparing uniform search strategies.

Heuristic search strategies [4]

Greedy best-first search, A* search, memory bounded heuristic search: local search algorithms & optimization problems: Hill climbing search, simulated annealing search, local beam search, genetic algorithms; constraint satisfaction problems, local search for constraint satisfaction problems.

Adversarial search [3]

Games, optimal decisions & strategies in games, the minimax search procedure, alpha-beta pruning, additional refinements, iterative deepening.

Module 3: Knowledge & Reasoning [11L]

Knowledge & Reasoning [3]

Knowledge representation issues, representation & mapping, approaches to knowledge representation, issues in knowledge representation.

Using predicate logic [4]

Representing simple fact in logic, representing instant & ISA relationship, computable functions & predicates, resolution, natural deduction.

Representing knowledge using rules [2]

Procedural verses declarative knowledge, logic programming, forward verses backward reasoning, matching, control knowledge.

Probabilistic reasoning [2]

Representing knowledge in an uncertain domain, the semantics of Bayesian networks, Fuzzy sets, and fuzzy logics.

Module 4: Different fields of AI [4L]

Natural Language Processing [2]

Introduction, Syntactic processing, semantic analysis, discourse, and pragmatic processing.

Expert Systems [2]

Representing and using domain knowledge, expert system shells, and knowledge acquisition. Basic knowledge of programming language like Prolog

Textbooks:

1. Artificial Intelligence, Ritch & Knight, TMH
2. Artificial Intelligence, A Modern Approach, Stuart Russel, Peter Norvig ,Pearson

Recommended books:

1. Introduction to Artificial Intelligence & Expert Systems, Patterson, PHI
2. Poole, Computational Intelligence, OUP
3. Logic &Prolog Programming, Saroj Kaushik, New Age International

4. Expert Systems, Giarranto, VIKAS

CO-PO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1	2	-	-	-	-	-	-	-	-	-
CO2	2	2	3	-	3	-	-	-	-	-	-	-
CO3	2	2	3	2	-	-	-	-	-	-	-	-
CO4	2	2	-	2	-	-	-	-	-	-	-	-
CO5	3	3	3	3	-	-	-	-	-	-	3	2

Paper Name: ROBOTICS
Code: CS701B
Contacts: 3L
Credits: 3
Allotted hours: 35L

Prerequisite:

1. Microprocessor & Microcontroller
2. Computer Organization & Architecture

Course Objective(s):

- To study microcontroller operations for robotics.
- To study how different interfaces are actually implemented in a microcontroller.
- To learn how Microchip PIC micro PIC16F627 can be erased and reprogrammed
- To learn how different sensors, outputs, and peripherals can be wired to a microcontroller to work cooperatively and create a high-level control program.
- To design robots in a real time environment.

Course Outcome(s):
After the successful completion of this course, the student will be able to:

CO1 To describe and explain the microcontrollers used the in robots.
CO2. To design the software and build the prototype of robots.
CO3. To apply localization and mapping aspects of mobile robotics.
CO4. To demonstrate self-learning capability.

Course contents:

MODULE I (5L)
Brief history, types, classification and usage, Science and Technology of robots, Some useful websites, textbooks and research journals.

Position and orientation of a rigid body, Homogeneous transformations, Representation of joints, link representation using D-H parameters, Examples of D-H parameters and link transforms, different kinds of actuators – stepper, DC servo and brushless motors, model of a DC servo motor, Types of transmissions, Purpose of sensors, internal and external sensors, commonsensors – encoders, tachometers, strain gauge based force-torque sensors, proximity and distance measuring sensors, and vision.

MODULE II (8L)

Introduction, Direct and inverse kinematics problems, Examples of kinematics of common serial manipulators, workspace of a serial robot, Inverse kinematics of constrained and redundant robots, Tractrix based approach for fixed and free robots and multi-body systems, simulations and experiments, Solution procedures using theory of elimination, Inverse kinematics solution for the general 6R serial manipulator.

Degrees-of-freedom of parallel mechanisms and manipulators, Active and passive joints, Constraint and loop-closure equations, Direct kinematics problem, Mobility of parallel manipulators, Closed-from and numerical solution, Inverse kinematics of parallel manipulators and mechanisms, Direct kinematics of Gough-Stewart platform.

MODULE III (8L)

Linear and angular velocity of links, Velocity propagation, Manipulator Jacobians for serial and parallel manipulators, Velocity ellipse and ellipsoids, Singularity analysis for serial and parallel manipulators, Loss and gain of degree of freedom, Statics of serial and parallel manipulators, Statics and force transformation matrix of a Gough-Stewart platform, Singularity analysis and statics.

Mass and inertia of links, Lagrangian formulation for equations of motion for serial and parallel manipulators.

MODULE IV (9L)

Joint and Cartesian space trajectory planning and generation, Classical control concepts using the example of control of a single link, Independent joint PID control, Control of a multi-link manipulator, Non-linear model based control schemes, Simulation and experimental case studies on serial and parallel manipulators, Control of constrained manipulators, Cartesian control, Force control and hybrid position/force control, Advanced topics in non-linear control of manipulators.

MODULE V (5L)

Introduction and some well known wheeled mobile robots (WMR), two and three-wheeled WMR on flat surfaces, Slip and its modeling, WMR on uneven terrain, Design of slip-free motion on uneven terrain, Kinematics, dynamics and static stability of a three-wheeled WMR‘s on uneven terrain, Simulations using Matlab and ADAMS.

Introduction to chaos, Non-linear dynamics and chaos in robot equations, Simulations of planar 2 DOF manipulators, Analytical criterion for unforced motion. Gough-Stewart platform and its singularities, use of near singularity for fine motion for sensing, design of Gough-Stewart platform

based sensors. Over-constrained mechanisms and deployable structures, Algorithm to obtain redundant links and joints, Kinematics and statics of deployable structures with pantographs or scissor-like elements (SLE's).

Textbooks:

1. Myke Predko, ―Programming Robot Controllers‖ – McGrawHill, 1st edition, 2003.

Reference books:

1. Michael slater, ―Microprocessor – based design: A comprehensive Guide to Effective Hardware Design, Prentice Hall, 1989.
2. Myke Predko, ―Programming and customizing the 8051- micro-controller‖, Tata McGraw-Hill, New Delhi, 2000.
3. Kenneth J. Ayala, ―The 8051 micro-controller architecture, programming and applications, Penram International publishers, Mumbai, 1996.
4. Murphy Robin R,‖ Introduction to AI Robotics‖, MIT Press, 2000.
5. Siegwart R and Nourbakhsh I.R, ―Introduction to Autonomous mobile Robots‖, Prentice Hall India, 2005.
6. Roland Siegwart, Illah R. Nourbakhsh, ―Introduction to Autonomous mobile Robots‖, MIT Press, 2005.

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

Name of the Paper: Data Analytics
Paper Code: CS701C
Contact (Periods/Week):3L/Week
Credit Point: 3
No. of Lectures: 36

Prerequisite:

1. Familiarity and knowledge of Database Management Systems
2. Concepts of probability and statistics
3. Proficiency of algorithms
4. Programming skills of C, Python

Course Objective(s):

- Conceptualization and summarization of big data and trivial data versus big data
- Big data computing technologies.
- Help students learn, understand, and practice big data analytics with distributed approaches.
- Learn and understand different programming model of big data.

Course Outcome(s):

CO1 To understand the basic terminologies of data definition and the different analysis techniques.
CO2 To identify the analysis techniques to appropriately apply in problems.

CO3 To know the fundamental of data different analysis techniques.
CO4 To apply the learned techniques in different real-life projects.

Course Content

Module I: Data Definitions and Analysis Techniques [10L]
Elements, Variables, and Data categorization [2L]
Levels of Measurement [1L]
Data management and indexing [2L]
Introduction to statistical learning and R-Programming- BASE (Basically Available Soft State Eventual Consistency)- Few top Analytics tools [3L]

Descriptive Statistics Measures of central tendency**,** Measures of location of dispersions [2L]

Module II: Basic analysis techniques [8L]
Statistical hypothesis generation and testing [2L], Chi-Square test [1L], t-Test [1L]
Analysis of variance [1L], Correlation analysis [2L], Maximum likelihood test [1L]

Module III: Data analysis techniques [9L]
Regression analysis [2L], Classification techniques [3L], Clustering [2L], Association rules analysis [2L]

Module IV: Case studies and projects [9L]
Understanding business scenarios [1L], Feature engineering and visualization [2L], Scalable and parallel computing with Hadoop and Map-Reduce [4L], Sensitivity Analysis [2L]

Textbooks:
1. Mark Dexter, Louis Landry, "Joomla Programming", 2012 Pearson Education.
2. Seema Acharya and Subhashini C, "Big Data and Analytics", Wiley Publication, 2015

Recommended books:
1. Judith Hurwitz, Alan Nugent, Fern Halper, Marcia Kaufman, "Big data for dummies", Wiley Publication, 2013.
2. Tom White, "Hadoop: The Definitive Guide", O"Rilly Publication, 2015.
3. Chuck Lam, "Hadoop in action", Dreamtech Press, 2011.
4. Dirk Deroos, Paul C. Zikopoulos, Roman B. Melnyk, Bruce Brown, "Hadoop for dummies", Wileypublication, 2015.

CO-PO Mapping

CO	PO1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	2	2	2	2	3	1	-	-	1	1	1	1
CO2	2	2	2	2	3	1	-	-	1	1	1	1
CO3	2	2	2	2	3	1	-	-	1	1	1	1
CO4	2	2	2	2	3	1	-	-	1	1	1	1

Paper Name: Soft Computing
Code: CS 702A
Contacts: 3L

Credits: 3
Allotted hours: 36L

Prerequisite:
A solid background in mathematical and programming Knowledge

Course Objective(s):

- To learn the basics of Soft Computing usage
- To learn the basics of many optimization algorithm
- To learn to solve and optimize the real-world problem using soft computing methodology.

Course Outcome(s):

CO1 To acquire the knowledge of soft computing and hard computing.
CO2 To develop skill in soft computing methodology.
CO3 To understand the concept and techniques of designing and implementing of soft computing methods in real world problem.
CO4 To acquire the knowledge of the fuzzy Neural network and Genetic Language.
CO5 To analyse and optimized the problem of real-life applications.

Course Content:

Soft Computing: Module-I [6L]

An Overview of Artificial Intelligence
Soft Computing: Introduction of soft computing, soft computing vs. hard computing, various types of soft computing techniques, applications of soft computing.
Artificial Intelligence: Introduction, Various types of production systems, characteristics of production systems, breadth first search, depth first search techniques, other Search Techniques like hill Climbing, Best first Search, A* algorithm, AO* Algorithms and various types of control.

Soft Computing: Module-II [8L]

Introduction to derivative free optimization, GA; biological background, search space of genetic algorithm, genetic algorithm Vs. Traditional algorithm; Simple genetic algorithm, Genetic algorithm Operators: Encoding, selection criteria, Crossover, Mutation, advantages and disadvantages of genetic algorithm, Convergence of GA, Applications & advances in GA, Differences & similarities between GA & other traditional method.

Soft Computing: Module-III [12L]

Neural Network: Biological neuron, artificial neuron, definition of ANN, Taxonomy of neural net, Difference between ANN and human brain, Structure and Function of a single neuron, characteristics and applications of ANN, single layer network, Perceptron training algorithm, Linear separability, Widrow & Hebb;s learning rule/Delta rule, ADALINE, MADALINE, AI v/s ANN.
Introduction of MLP, different activation functions, Error back propagation algorithm, derivation of EBPA, momentum, heuristic, limitation, characteristics and application of EBPA.
Adaptive Resonance Theory: Architecture, classifications, Implementation and training, Associative Memory.

Soft Computing: Module-IV [10L]

Fuzzy Logic: Fuzzy set theory, Fuzzy set versus crisp set, Crisp relation & fuzzy relations, Fuzzy systems: crisp logic, fuzzy logic, introduction & features of membership functions,

Fuzzy rule base system: fuzzy propositions, formation, decomposition & aggregation of fuzzy rules, fuzzy reasoning, fuzzy inference systems, fuzzy decision making & Applications of fuzzy logic.

Textbooks:
1. Fuzzy logic with engineering applications, Timothy J. Ross, John Wiley and Sons.
2.Neural Networks: A Comprehensive Foundation (2nd Edition), Simon Haykin, Prentice Hall.

Reference Books:
1. K.H.Lee. First Course on Fuzzy Theory and Applications, Springer-Verlag.
2. J. Yen and R. Langari.. Fuzzy Logic, Intelligence, Control and Information, Pearson Education.

CO-PO Mapping

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

Name of the Paper: Natural Language Processing
Paper Code: CS702B
Contact (Periods/Week):3L/Week
Credit Point: 3
No. of Lectures: 35

Prerequisite:
A solid background in mathematics and statistics, including probability, set theory.

Course Objective(s):
- To learn the basics of NLP
- To learn the principles and application of different NLP techniques
- To learn the details of NLP algorithms, different tools and knowing their use

Course Outcome(s):
On completion of the course students will be able to

CO1 To gain knowledge of the fundamental concept of NLP, Regular Expression, Finite State Automata along with the concept and application of word tokenization, normalization, sentence segmentation, word extraction, spell checking in the context of NLP.
CO2 To understand the concept of Morphology such as Inflectional and Derivational Morphology and different morphological parsing techniques including FSTs.
CO3 To acquire the concepts related to language modeling with introduction to N-grams, chain rule, smoothing, Witten Bell discounting, backoff, deleted interpolation, spelling and word prediction and their evaluation along with the concept of Markov chain, HMM, Forward and Viterbi algorithm, POS tagging.
CO4 To develop the concept of different text classification techniques, sentiment analysis, concepts related to CFG in the context of NLP, concept of lexical semantics, lexical dictionary such as

WordNet, lexical computational semantics, distributional word similarity and concepts related to the field of Information Retrieval in the context of NLP.

Course Content

Module I: [9L]

Introduction to NLP [2L]

Human languages, models, definition of NLP, text representation in computers, encoding schemes, issues and strategies, application domain, tools for NLP, Linguistic organisation of NLP, phase in natural language processing, applications.

Regular Expression and Automata [2L]

Finite State Automata. Introduction to CFG and different parsing techniques.

Tokenization [4L]

Word Tokenization, Normalization, Sentence Segmentation, Named Entity Recognition,Multi Word Extraction, Spell Checking – Bayesian Approach, Minimum Edit Distance

Morphology [1L]

Morphology – Inflectional and Derivational Morphology, Finite State Morphological Parsing, The Lexicon and Morphotactic, Morphological Parsing with Finite State Transducers, Orthographic Rules and Finite State Transducers, Porter Stemmer.

Module II: [9L]

Language Modelling[4L]

Introduction to N-grams, Chain Rule, smoothing – Add-One Smoothing, Witten-Bell Discounting; Backoff, Deleted. Interpolation, N-grams for Spelling and Word Prediction, Evaluation of language models. Spelling errors, detection and elimination using probabilistic models, pronunciation variation (lexical, allophonic, dialect), decision tree model, counting words in Corpora.

Hidden Markov Models and POS Tagging **[5L]**

Markov Chain, Hidden Markov Models, Forward Algorithm, Viterbi Algorithm, Part of Speech Tagging – Rule based and Machine Learning based approaches, concept of HMM tagger Evaluation. Handling of unknown words, named entities, multi word expressions.

Module III: [9L]

Text Classification [4L]

Text Classification, Naïve Bayes' Text Classification, Evaluation, Sentiment Analysis – Opinion Mining and Emotion Analysis, Resources and Techniques.

Context Free Grammar [5L]

Context Free Grammar and Constituency, Some common CFG phenomena for English, Top-Down and Bottom-up parsing, Probabilistic Context Free Grammar, Dependency Parsing

Module IV: [8L]

Computational Lexical Semantics [5L]

Introduction to Lexical Semantics – Homonymy, Polysemy, Synonymy, Thesaurus – WordNet, VerbNet, Computational Lexical Semantics – Thesaurus based and Distributional Word Similarity, Lexemes (homonymy, polysemy, synonymy, hyponymy), word structure, metaphor, metonymy.

Word sense disambiguation, machine learning approaches, dictionary based approaches.

Information Retrieval [3L]

Boolean Retrieval, Term-document incidence, The Inverted Index, Query Optimization, Phrase Queries, Ranked Retrieval, Term Frequency and Inverse Document Frequency based ranking, Zone Indexing, Query term proximity, Cosine ranking, Combining different features for ranking, Search Engine Evaluation, Relevance Feedback.

Resource management with XML, Management of linguistic data with the help of GATE, NLTK

Textbooks:

1. D. Jurafsky& J. H. Martin – "Speech and Language Processing – An introduction to Language processing, Computational Linguistics, and Speech Recognition",Pearson Education
2. Chris Manning and Hinrich Schütze, "Foundations of Statistical Natural Language Processing", MIT Press. Cambridge, MA: May 1999.

Reference books:

1. Allen, James. 1995. – "Natural Language Understanding". Benjamin/Cummings, 2ed.
2. Bharathi, A., Vineet Chaitanya and Rajeev Sangal. 1995. Natural Language Processing- "A Pananian Perspective". Prentice Hll India, Eastern Economy Edition.
3. Siddiqui T., Tiwary U. S.. "Natural language processing and Information retrieval", OUP, 2008.
4. Eugene Cherniak: "Statistical Language Learning", MIT Press, 1993.
5. Manning, Christopher and Heinrich Schütze. 1999. "Foundations of Statistical Natural Language Processing". MIT Press.

CO-PO Mapping

CO	PO1	PO2	POP3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	2	3	3	3	-	-	-	-	-	1	2
CO2	-	2	2	2	1	-	-	-	-	-	-	1
CO3	-	2	3	3	3	3	-	-	-	-	2	-
CO4	3	2	2	2	1	3	2	-	-	-	3	2

Name of the Paper: Web Technology
Paper Code: CS702C
Contact (Periods/Week): 3L/Week
Credit Point: 3
No. of Lectures: 35

Course Objective(s):

- To impart the design, development and implementation of Static and Dynamic Web Pages.
- To develop programs for Web using Scripting Languages and .net framework.
- To give an overview of Server Side Programming in Web.

Course Outcome(s):

CO1 To understand the notions of World Wide Web(www), Internet, HTTP Protocol, Web Browsers, Client-Server, etc.
CO2 To develop interactive web pages using HTML, DHTML and CSS
CO3 To procure the knowledge of different information interchange formats like XML.
CO4 To design web applications using scripting languages like JavaScript, CGI, PHP
CO5 To acquire the server side programming concepts using servlet, JSP and .Net framework.

Course Contents:

Module 1: [4L]
Introduction to Web [4L]: Concept of World Wide Web (www), Internet and the relation with www **[1L];** The Internet - Basic Internet Protocols, HTTP Protocol - Request and Response, Web browser **[1L];** Web clients and Web servers, Dynamic IP **[1L];** Clients, Servers, and Communication, Web site design principles, Planning the site and navigation **[1L].**

Module -2: [9L]
HTML, DHTML & CSS [6L]: Introduction, Elements, Attributes, Heading, Paragraph. Formatting **[1L];** Link, Table, List, Block, Layout, Html Forms and input **[1L];** Iframe, Colors, Image Maps and attributes of image area **[2L];** Introduction to CSS, basic syntax and structure of CSS, different types-internal, external and inline CSS **[1L];** Basic Introduction of DHTML, Difference between HTML and DHTML, Documentary Object Model (DOM) **[1L].**
Extended Markup Language (XML) [3L]: Introduction, Difference between HTML & XML, XML-Tree **[1L];** Syntax, Elements, Attributes, Validation and parsing, DTD **[2L].**

Module 3: [8L]
Java Scripts [4L]: Basic Introduction, Statements, comments, variable, operators, data types**[1L];** condition, switch, loop, break **[1L];** Java script functions, objects, and events**[1L].**
CGI Scripts [1L]: Introduction, Environment Variable, GET and POST Methods.
PHP Scripting [4L]: Introduction, Syntax, Variables, Output, Data types, String, Constants**[1L];** Operator, Decision Control statements**[1L];** switch-case, Loop, PHP function**[1L];** array, Form Handling**[1L].**

Module-4: [14L]
Java Server Page (JSP) [8L]:
JSP Architecture **[1L];** JSP Servers, JSP Life Cycle **[1L];** Understanding the layout of JSP, JSP Scriptlet Tag **[1L];** JSP implicit object (request and response) **[1L];** Variable declaration, methods in JSP **[1L];** JSP directive (Taglib and Include), JavaBean- inserting JavaBean in JSP **[1L];** JSP Action tags (Forward & Include) **[1L];** Creating ODBC data source name, Introduction to JDBC, prepared statement and callable statement **[1L].**
Java Servlet [3L]: Servlet environment and role, Servlet life cycle **[1L];** Servlet methods- Request, Response, Get and post **[1L];** Cookies and Session **[1L].**

.NET Framework [3L]: ASP.Net with MVC introduction, MVC Architecture, MVC routing, controller, Action method, Action Selector and Action verb, Model and View **[1L];**.net framework, C#.net introduction, environment variable, basic syntax of conditional statement, loop and function**[2L].**

Textbooks:

1. "Web Technology: A Developer's Perspective", N.P. Gopalan and J. Akilandeswari, PHI Learning, Delhi, 2013. **(Topics covered: html, CSS, imagemap, xml)**
2. "Learning PHP, MySQL & JavaScript", Robin Nixon, O'Reilly Publication. (**Topics covered: PHP, Java Script)**
3. "Head First Servlet's & JSP", Bryan Basham, Kathy Sterra, Bert Bates, O'Reilly Publication. (**Topics covered: Servlet, JSP)**
4. ASP.NET Core 2.0 MVC And Razor Pages For Beginners:" Jonas Frajerberg, O'Reilly Publication. (**Topics covered: MVC, ASP.Net, C#)**

Recommended books:

1. "Programming the World Wide Web", Robert. W. Sebesta, Fourth Edition, Pearson Education, 2007.
2. "Core Web Programming"- Second Edition-Volume I and II, Marty Hall and Larry Brown, Pearson Education, 2001.

CO-PO Mapping

CO	PO1	PO2	PO3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO12
CO1	1	-	2	-	-	-	-	-	-	-	-	-
CO2	-	2	3	2	-	-	-	-	-	-	-	-
CO3	-	2	2	-	-	-	-	-	-	-	-	-
CO4	1	2	3	2	-	-	-	-	-	-	-	-
CO5	1	-	3	2	-	-	-	-	-	-	-	-

Paper Name: Cloud Computing
Code: CS703A
Contacts: 3:0:0
Credits: 3
Total Contact hours: 36L

Prerequisite

1. Should have the basic knowledge of Operating Systems.
2. Should be aware of the fundamental concepts of Networking.
3. Should have knowledge of heterogeneous systems and resource management.

Course Objective(s):

- To learn the workflow of cloud business model and optimized resource allocation.

- To gain knowledge of cloud service and delivery models and develop an understanding of the risk and compliance responsibilities and Challenges for each Cloud type and service delivery model.
- To learn virtualization techniques, load balancing, and work strategy of different cloud infrastructure.
- To know the security and privacy issues in cloud infrastructure

Course Outcome(s):

CO1 To articulate the business model concepts, architecture and infrastructure of cloud computing, including cloud service models and deployment models.
CO2 To apply and design suitable Virtualization concept, Cloud Resource Management and design scheduling algorithms.
CO3 To explore some important cloud computing driven commercial systems such as Google Apps, Microsoft Azure and Amazon Web Services and other businesses cloud applications.
CO4 To analyse the core issues of cloud computing such as security, privacy, interoperability, and its impact on cloud application.

Course Contents:

Module 1: Definition of Cloud Computing and its Basics [8L]

1. 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 – a shift in paradigm Benefits and advantages of Cloud Computing [3]

2. Cloud Architecture: Cloud Infrastructure, Architecture of each components, Virtualization versus Traditional Approach, Virtualization Model for Cloud Computing. [2]

3. Services and Applications by Type [3]
IaaS – Basic concept, Workload, partitioning of virtual private server instances, Pods, aggregations, silos.
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: Use of Platforms in Cloud Computing [6L]

1. Concepts of Abstraction and Virtualization [2L]

Virtualization technologies: Types of virtualization, Load Balancing and Virtualization: Basic Concepts, Network resources for load balancing; Classification of Virtualization Environment: Scheduling-based Environment, Load-Distribution-Based Environment, Energy Aware-Based Environment, Operational-Based Environment, Distributed Pattern-Based Environment, Transactional-Based Environment

2. Mention of The Google Cloud as an example of use of load balancing Hypervisors: Virtual machine technology and types, VMware vSphere Machine imaging (including mention of Open Virtualization Format – OVF) [2L]
Porting of applications in the Cloud: The simple Cloud API and AppZero Virtual Application appliance
3. Concepts of Platform as a Service [2L]
Definition of services, Distinction between SaaS and PaaS (knowledge of Salesforce.com and Force.com), Application development.Use of PaaS Application frameworks.

Module 3: Cloud Service Models [6L]

1. Use of Google Web Services [2L]
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.

2. Use of Amazon Web Services [2L]

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

3. Use of Microsoft Cloud Services [2L]
Windows Azure platform: Microsoft's approach, architecture, and main elements, overview of Windows Azure AppFabric, Content Delivery Network, SQL Azure, and Windows Live services

Module 4: Cloud Infrastructure [10L]

Types of services required in implementation – Consulting, Configuration, Customization and Support

1. Cloud Management [3L]
An overview of the features of network management systems and a brief introduction of related products from large cloud vendors, Monitoring of an entire cloud computing deployment stack – an overview with mention of some products, Lifecycle management of cloud services (six stages of lifecycle)

2. Live Migration of Virtual Machines: [2L]
Need of Live Migration of Virtual Machine, A Designing Process of Live Migration, and Security Issues during live migration.

3. Concepts of Cloud Security [3L]
Infrastructure Security, Infrastructure Security: The Network Level, The Host Level, The Application Level, Data Security and Storage, Aspects of Data Security, Data Security Mitigation Provider Data and Its Security, Identity and Access Management.
4. Auditing and Compliance in Cloud Environment: [2L]
Data Security in Cloud Computing Environment, Need for Auditing in Cloud Computing Environment, Third Party Service Provider, Cloud Auditing Outsourcing Lifecycle Phases, Auditing Classification.

Module 5: Concepts of Services and Applications [6L]

1. Service Oriented Architecture: Basic concepts of message-based transactions, Protocol stack for an SOA architecture, Event-driven SOA, Enterprise Service Bus, Service catalogs [6]

2. Applications in the Cloud: Concepts of cloud transactions, functionality mapping, Application attributes, Cloud service attributes, System abstraction and Cloud Bursting, Applications and Cloud APIs [2]

3. Cloud-based Storage: Cloud storage definition – Manned and Unmanned. [1]

4. Webmail Services: Cloud mail services including Google Gmail, Mail2Web, Windows Live Hotmail, Yahoo mail, concepts of Syndication services [1]

Textbooks:

1.Mastering Cloud Computing by Rajkumar Buyya, Christian Vecchiola, S. Thamarai Selvi, McGraw Hill Education (India)PrivateLimited,2013

2. Fundamentals of Cloud Computing by P. K. Pattnaik, S. Pal, M. R. Kabat, Vikas Publications, 2014.

Reference Books:

1. Cloud Computing Bible by Barrie Sosinsky, Wiley India Pvt. Ltd, 2013
2. Cloud Computing: A Practical Approach, Anthony T. Velte, Tata Mcgraw-Hill

CO-PO Mapping

CO	PO 1	PO 2	PO3	PO 4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12
CO1	-	-	-	2	-	-	-	-	-	-	-	-
CO2	-	-	1	-	-	-	2	-	-	-	3	-
CO3	-	-	-	-	-	2	-	-	3	-	-	-
CO4	-	-	-	-	-	-	-	3	2	-	-	-

Course Name: Sensor Network and IOT
Course Code: CS703B
Contact: 3L/Week
Total Contact Hours: 35
Credit Point: 3

Prerequisites:

1. Familiar with basic Computer Networks concepts
2. Basic knowledge of Microcontroller fundamentals

Course Objective(s):

- To gain knowledge of the sensor network protocols and sensor deployment strategies.
- explore the interconnection and integration of the physical world and the cyberspace.
- To understand building blocks of Internet of Things and characteristics.
- To design and develop IoT Device.

Course Outcome(s):

CO1 To analyse basic protocols in wireless sensor network.
CO2 To understand the concepts of Internet of Things.
CO3 To recognize the M2M communication protocols.
CO4 To design IoT applications in different domain on embedded platform and be able to analyse their performance.

Course Contents:

Module -1: [11L] Wireless Sensor Networks Fundamentals

Wireless medium access issues [1L]

MAC Protocols for Wireless Sensor Networks, Low Duty Cycle Protocols and Wakeup Concepts - S-MAC, The Mediation Device Protocol, Wakeup Radio Concepts, Contention based protocols (CSMA, PAMAS) [2L]

Schedule based protocols (LEACH, SMACS, TRAMA) Address and Name Management in WSNs, Assignment of MAC Addresses [2L]

Routing Protocols- Energy-Efficient Routing, Geographic Routing, Hierarchical networks by clustering. [2L]

Sensor deployment & Node discovery [2L]

Data aggregation & dissemination [2L]

Module -2: [6L] Fundamentals on IoT

Definition of IoT and Characteristics of IoT [1L] Physical and logical design of IoT [2L] Functional blocks of IoT [1L]

Communication models &APIs: Internet connectivity, Internet-based communication, IPv4, IPv6,6LoWPAN protocol, IP Addressing in the IoT, Application layer protocols: HTTP, HTTPS, FTP, TELNET and ports. [2L]

Module 3: [7L]

Machine to machine Communication and IoT

M2M communication and Modified OSI Model for the IoT/M2M Systems [1L]

Data enrichment, data consolidation and device management at IoT/M2M Gateway [2L] Web communication protocols used by connected IoT/M2M devices [2L]

Message communication protocols (CoAP-SMS, CoAP-MQ, MQTT, XMPP) for IoT/M2M devices [2L]

Module -4: [11L]

IoT Prototyping and Security

Introduction to Prototyping Embedded device software [1L] Programming Embedded Device Arduino Platform using IDE [1L]

Reading data from sensors and devices, Devices, Gateways [2L] Internet and Web/Cloud services software development [1L] Programming MQTT clients and MQTT server [2L] Introduction to IoT privacy and security [2L]

Vulnerabilities, security requirements and threat analysis [1L] Domain specific applications of IoT [1L]

Textbooks:

1. Vijay Madisetti, ArshdeepBahga, “Internet of Things: A Hands-On Approach”, Orient BlackSwan
2. WaltenegusDargie,ChristianPoellabauer, "Fundamentals of Wireless Sensor Networks: Theory and Practice", Wiley

Recommended books:

1. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton, Jerome Henry, Rowan Trollope, “IoT Fundamentals: Networking Technologies, Protocols and Use Cases for the Internet of Things”, Pearson
2. C. Siva Ram Murthy, B. S. Manoj, “Ad Hoc Wireless Networks: Architectures and Protocols”, Prentice Hall

CO-PO Mapping

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

Name of the Paper: Cryptography and Network Security
Paper Code: CS703C
Contact (Periods/Week): 3L/Week
Credit Point: 3
No. of Lectures: 36

Prerequisite:
1. Knowledge of Computer Networks and Operating Systems fundamentals
2. Understanding of Discreet Mathematics concepts

Course Objective(s)
- To impart concepts on cryptography and Network security
- To gain knowledge of the standard algorithms used to provide confidentiality, integrity, and authenticity.
- To recognize the various key distribution and management systems for security of a cryptosystem

Course Outcome(s):
CO1 To understand the basic concepts in cryptography.
CO2 To apply the deployment of different encryption techniques to secure messages in transit across data networks.
CO3 To discuss various techniques used to assure Integrity and Authentication.
CO4 To analyse diverse security measures and issues in practice.

Module -1: [7L]
INTRODUCTION AND NUMBER THEORY
Introduction - Services, Mechanisms, and Attacks, OSI security architecture, Network security model**[1L]**
Classical Encryption techniques (Symmetric cipher model, substitution techniques, transposition techniques, steganography) **[3L]**
Finite Fields and Number Theory: Groups, Rings, Fields, Modular arithmetic, Euclid's algorithm**[1L]**
Polynomial Arithmetic, Prime numbers, Fermat"s and Euler"s theorem**[1L]**
Testing for primality -The Chinese remainder theorem - Discrete logarithms **[1L]**

Module -2: [9L]
BLOCK CIPHERS AND PUBLIC KEY CRYPTOGRAPHY
Data Encryption Standard- Block cipher principles, block cipher modes of operation**[2L]**
Advanced Encryption Standard (AES), Triple DES, Blowfish, RC5 algorithm**[3L]**
Public key cryptography: Principles of public key cryptosystems, The RSA algorithm**[2L]**
Key management - Diffie Hellman Key exchange, Elliptic curve arithmetic, Elliptic curveM cryptography **[2L]**

Module 3: [6L]
HASH FUNCTIONS AND DIGITAL SIGNATURES
Authentication requirement, Authentication function, MAC, Hash function **[2L]**
Security of hash function and MAC, MD5, SHA, HMAC, CMAC **[2L]**
Digital signature and authentication protocols, DSS, ElGamal, Schnorr **[2L]**

Module -4: [7L]
SECURITY PRACTICE AND SYSTEM SECURITY
Authentication applications, Kerberos, X.509 **[1L]**
Internet Firewalls for Trusted System: Roles of Firewalls, Firewall related terminology- Types of Firewalls, Firewall designs principles **[1L]**
SET for E-Commerce Transactions **[1L]**
Intruder, Intrusion detection system **[1L]**
Virus and related threats, Countermeasures **[1L]**

Trusted systems, Practical implementation of cryptography and security **[2L]**

Module -5: **[7L]**
E-MAIL, IP, AND WEB SECURITY
E-mail Security: Security Services for E-mail-attacks possible through E-mail, Establishing keys privacy, authentication of the source [**1L]**
Message Integrity, Non-repudiation, Pretty Good Privacy, S/MIME **[2L]**
IP Security: Overview of IPSec, IPv4 and IPv6-Authentication Header, Encapsulation Security Payload (ESP) **[1L]**
Internet Key Exchange (Phases of IKE, ISAKMP/IKE Encoding) **[1L]**
Web Security: SSL/TLS Basic Protocol, computing the keys, client authentication **[1L]**
PKI as deployed by SSL Attacks fixed in v3, Exportability, Encoding, Secure Electronic Transaction **[1L]**

Textbooks:
1. Atul Kahate, "Cryptography and Network Security", Third edition, McGraw Hill Education

Recommended books:
1. William Stallings, "Cryptography and Network Security: Principles and Practice", Sixth edition, Pearson
2. Behrouz A. Forouzan, Debdeep Mukhopadhyay, "Cryptography and Network Security",Second edition, McGraw Hill Education
3. Atul Kahate, "Cryptography and Network Security", Third edition, McGraw Hill Education
4. William Stallings, "Cryptography and Network Security: Principles and Practice", Sixth edition, Pearson
5. Behrouz A. Forouzan, Debdeep Mukhopadhyay, "Cryptography and Network Security",Second edition, McGraw Hill Education

CO	PO1	PO2	PO 3	PO4	PO 5	PO 6	PO7	PO8	PO9	PO10	PO 11	PO 12
CO1	1	-	2	-	-	2	2	3	-	-	-	-
CO2	3	2	1	1	3	3	-	3	-	-	-	-
CO3	1	3	3	1	3	3	3	3	-	-	-	-
CO4	-	3	3	3	-	-	-	-	-	-	2	-

PRACTICAL

Course Name: Artificial Intelligence Lab
Course Code: CS791A

Objectives

- To learn the fundamentals of PROLOG/ LISP Programming.
- To impart adequate knowledge on the need of PROLOG/ LISP programming languages and problem solving techniques.

Course Outcome(s):

CO1 To learn the concept of simple programming using PROLOG/ LISP
CO2 To understand the concept of AI based programs using PROLOG/ LISP
CO3 To develop the capability to represent various real life problem domains using logic based techniques.

Course contents:

Programming Languages such as PROLOG or LISP covering the sample following topics (but not limited to):-

1. Write a program to find the maximum of three numbers.
2. Write a program to calculate factorial of a number.
3. Write a program in PROLOG to calculate GCD of two numbers.
4. Write a program in PROLOG to generate Fibonacci series.
5. Write a program in PROLOG to count the number of elements in a list.
6. Write a program to insert an element at the beginning/ middle/ end of a list.
7. Write a program in PROLOG to find the GCD of the elements of a list.
8. Write a program in PROLOG to find the maximum of a list.
9. Write a program in PROLOG to reverse a list
10. Write a program in PROLOG to check whether a number or string is palindrome or not.
11. Write a program in PROLOG to delete an element from a list.
12. Write a program in PROLOG for linear search/ binary search in a list.
13. Write a program in PROLOG to sort n numbers using bubble sort algorithm.
14. Write a program in PROLOG for Towers of Hanoi problem.
15. Write a program in PROLOG for 4-Queens problem.

CO-PO Mapping

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

Course Name: ROBOTICS LAB
Course Code: CS791B
Year: 4TH
Semester: 7th Semester
Total Contact Hours: 3P
Credits: 1.5

Course Objective
To gain knowledge on handling robots and program them according to a specific objective

Course Outcome(s):

After the completion of this course, the student should be able to:
CO1 To understand the practical operation of robots and test their degree of freedoms.
CO2 To analyze the gripper performance as per varying objectives.
CO3 To carry out case studies with robots for practical applications.
CO4 To evaluate the robot using simulation software.

Course contents:

1. Demonstration of ROBOT with 2 DOF, 3 DOF, 4 DOF
2. Study and selection of Gripper.
3. Programming exercise of robots for Pick and Place activity.
4. Case studies of applications in industry like Spray Painting or Welding
5. Exercise on Robotic Simulation software, using Fanuc Robo guide

CO-PO Mapping

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12
CO1	1	-	2	-	-	2	1	-	2	1	1	1
CO2	1	1	3	2	-	1	1	-	3	1	1	2
CO3	-	-	2	-	-	2	2	-	3	1	1	3
CO4	-	3	2	-	-	2	3	1	3	1	1	3

Name of the Paper: Data Analytics Lab
Paper Code: CS791C
Contact (Periods/Week): 3P/Week
Credit Point: 1.5

Prerequisite:
Familiarity with and knowledge of Database Management Systems

Course Objective(s):

1. To implement Map Reduce programs for processing big data.
2. To analyze big data using linear models.
3. To analyze big data using machine learning techniques such as SVM / Decision tree classification and clustering .

Course Outcome(s):

CO1	To process big data using Hadoop framework
CO2	To build and apply linear and logistic regression models
CO3	To perform data analysis with machine learning methods
CO4	To perform graphical data analysis
CO5	To implement clustering techniques

Course Contents:

1. Install, configure and run Hadoop and HDFS

2. Implement word count / frequency programs using MapReduce

3. Implement an MR program that processes a weather dataset using Hadoop

4. Implement Linear and logistic Regression using R

5. Implement SVM / Decision tree classification techniques using R

6. Implement clustering techniques using R

7. Visualize data using any plotting framework using R

CO-PO Mapping:

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO-10	PO-11	PO-12
CO1	2	2	2	2	3	1	-	-	1	1	1	1
CO2	2	2	2	2	3	1	-	-	1	1	1	1
CO3	2	2	2	2	3	1	-	-	1	1	1	1
CO4	2	2	2	2	3	1	-	-	1	1	1	1

Paper Name: Soft Computing Lab
Code: CS 792A
Contacts: 3P
Credits: 1.5

Prerequisite:

1. Familiarity with the Matlab/ Python command
2. A solid background in mathematical and programming Knowledge

Course Objective(s)

- To learn to implement soft computing methods.
- To learn to solve the real world problem through program of Matlab/ Python
- To learn to solve and optimize the real world problem using Matlab /Python

Course Outcome(s):

CO1 To understand the concept and techniques of designing and implementing of soft computing methods in real world problem
CO2 To acquire the knowledge of the fuzzy Neural network and Genetic Language.
CO3 To analyze and optimized the problem of real-life applications.

Lab

1. Python/Matlab programming introduction
2. Python/Matlab programming fundamental
3. Matlab tool box implementation. / Python introduction to numerical calculation programming(scitific python, Numerical python, Image processing)
4. Python/ Matlab programming to simulate a single layer neural network designs
5. Python/ Matlab programming to simulate multiple layer neural network designs
6. Python/ Matlab programming to observe the perceptron learning algorithm performances for a single layer network. In this experiment, consider the XOR dataset
7. Write a Matlab/ python code for maximizing F(x)=x2,where x ranges from say 0 to 31 using Genetic Algorithm.
8. Use of Genetic Algorithm toolbox in matlab for optimization problem solving. Implementation of Simple Genetic Algorithm in python for solving optimization problem
9. WriteaMatlab/pythonprogramtoimplementthedifferentFuzzyMembershipfunctions
10. Write a Matlab/ python program to implement Fuzzy set operations and its properties

CO-PO Mapping

CO	PO1	PO2	POP3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	-	3	-	-	-	-	-	-	-	-	-
CO2	2	-	-	-	-	-	-	-	-	-	-	-
CO3	-	-	-	-	-	3	-	-	-	-	-	-

Name of the Paper: Natural Language Processing Lab
Paper Code: CS792B
Contact (Periods/Week):3L/Week
Credit Point: 2

Prerequisite:

1. Familiarity with the programming concepts in any language

2. A solid background in mathematics, including probability and statistics.

Course Objective(s)

- To learn the basics of NLTK toolkit
- To learn the principles of NLP through programming
- To build an application using different algorithms and natural language processing techniques

Course Outcome(s):

CO1 To access text corpora and lexical resources and process of raw text
CO2 To write structured programs for categorizing and tagging of words, segmentation of sentences
CO3 To classify text and extract information from it.
CO4 To analyse sentence structure, build feature based grammar, meaning of sentences and to manage linguistic data

Course Contents:

1. Introduction to list, dictionaries etc., input and output handling, saving data to files, retrieving data from files.
2. Writing functions and code reusing
3. Introduction to working knowledge of matplotlib, SciKit, NumPy and other necessary tools and libraries as per the need.
4. Language processing with python. Manipulating texts and words by writing programs programs.
5. Accessing text corpora, lexical resources,using WordNet through NLTK tool kit.
6. Processing raw text, normalizing, segmenting, applying regular expressions.
7. Writing programs to categorize texts, words, tagging words using tagger, generating tagged tokens, N-Gram tagging, text classification.
8. Writing programs to extract information from texts.
9. Writing programs to analyze sentence, its meaning etc.
10. Managing linguistic data through programs.

Textbooks:

1. Steven Bird, Ewan Klein, and Edward Loper. "Natural Language Processing– Analyzing Text with the Natural Language Toolkit". 2009, O'Reilly, 1ed.

Reference books:

1. Learning Python: Powerful Object-Oriented Programming: 5th Edition by Mark Lutz, 2013, O'Reilly.
2. Natural Language Toolkit documentation (https://www.nltk.org/)

CO-PO Mapping

CO	PO1	PO2	PO 3	PO4	PO 5	PO6	PO 7	PO8	PO9	PO10	PO 11	PO 12
CO1	2	1	2	2	-	2	-	-	-	2	-	-
CO2	1	2	2	2	-	-	2	3	3	2	2	2
CO3	-	2	3	3	3	1	1	-	2	3	-	2
CO4	2	2	2	2	2	3	1	2	-	-	1	3

Paper Name: Social Awareness
Code: MC781
Contact: 0:0:3

Course Objectives:

- To increase student awareness about the different societal issues
- To expose students to environmental issues and ecological concerns
- To make students self aware about their participatory role in sustaining society and the environment

List of Activities:

a) Social awareness camp at the college premises
b) Creating awareness in social issues
c) Environmental awareness ``
d) Activity related to social network, mobile awareness

8th Semester								
Sl. No.	**Course Code**	**Paper Code**	**Theory**	**Contact Hours/Week**				**Credit points**
				L	**T**	**P**	**Total**	
A. Theory								
1	HS	HU804	Principles of Management	2	0	0	2	2
2	PE	CS801	A. Mobile Computing B. Bio-informatics C. Cyber Law and Security Policy D. VLSI Design	3	0	0	3	3
3	PE	CS802	A. Parallel Computing B. Machine Learning C. Real Time Embedded System D. Advanced Computer Architecture	3	0	0	3	3
Total No of Theory							8	8
B. PRACTICAL								
4	PC	CS891	Design lab	0	0	2	2	1
	PROJ	PR 891	Project-VIII	0	0	0	6	3
C. MANDATORY ACTIVITIES / COURSES								
6	MC	MC 801	Essence of Indian Knowledge Tradition	3	0	0	3	
Total of Theory, Practical & Mandatory Activities/Courses							19	12

Theory

Paper Name: Principles of Management
Paper Code: HU 804
Contact: L-T-P= 3-0-0
Credits: 3

Course Objective(s):

- To develop ability to critically analyze and evaluate a variety of management practices in the contemporary context
- To understand and apply a variety of management and organizational theories in practice
- To be able to mirror existing practices or to generate their own innovative management competencies required for today's complex and global workplace
- To be able to critically reflect on ethical theories and social responsibility ideologies to create sustainable organizations

Course Contents:

Module 1: [4L]
Introduction to Management: definitions, managerial roles and functions; Science or Art perspectives- External environment-global, innovative and entrepreneurial perspectives of Management (3 Hrs.)– Managing people and organizations in the context of New Era- Managing for competitive advantage - the Challenges of Management.

Module 2: [6]
Early Contributions and Ethics in Management: Scientific Management- contributions of Taylor, Gilbreths, Human Relations approach-contributions of Mayo, McGregor's Theory, Ouchi's Theory Z .Systems Approach, the Contingency Approach, the Mckinsey 7-S Framework Corporate Social responsibility- Managerial Ethics.

Module 3: [6]
Planning: Nature and importance of planning, -types of plans (3 Hrs.)- Steps in planning, Levels of planning - The Planning Process. – MBO
Organising for decision making: Nature of organizing, organization levels and span of control in management Organisational design and structure –departmentation, line and staff concepts
Leading and Controlling: Leading Vs Managing – Trait approach and Contingency approaches to leadership - Dimensions of Leadership (3 Hrs.) - Leadership Behavior and styles – Transactional and Transformational Leadership
Basic control processcontrol as a feedback system – Feed Forward Control – Requirements for effective control – control techniques – Overall controls and preventive controls – Global controlling.

Module 4: [6]
Management of Physical Resources Plant: site selection procedures, factors affecting selection.
Layout-types and relative merits and demerits,
Maintenance-Objectives, different types of associated decisions, strategies for effective maintenance, computer applications.
Material : Functions, objectives, planning and control including inventory models with or without storage costs, price break (excluding dynamic and probabilistic considerations). Different classes of inventory. Material Requirement Planning (MRP).

Module 5: [4]

Quality management: Quality definition, quality planning, quality control and quality management, Total quality management, ISO 9000 systems, simple quality control techniques like control charts and acceptance sampling, Kaizen & Six Sigma.

Module 6: [4]
Marketing management consumer behavior, market research, product design and development pricing and promotion.

References
1. Harold Kooritz& Heinz Weihrich "Essentials of Management", Tata McGraw-Hill.
2. L.M. Prasad, Principles of Management , Sultan Chand & sons, New Delhi.
3. Sherlekar&sherlekar, Principles of Management, Himalaya Publishing House, New Delhi.

CO-PO mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO 7	PO 8	PO 9	PO1 0	PO 11	PO 12
CO1	_	_	_	_	_	1	1	1	1	2	_	_
CO2	_	_	_	_	_	1	1	3	1	2	_	_
CO3	_	_	_	_	_	3	2	-	_	1	_	3
CO4	_	_	_	_	_	_	2	1	3	_	_	-

Name of the Paper: Mobile Computing
Paper Code: CS801A
Contact (Periods/Week):3L/Week
Credit Point: 3
No. of Lectures: 35

Prerequisite:
1. Basic concept of computer network and communication engineering
2. Basic programming knowledge

Course Objective(s):
- To understand the basic concepts and principles in mobile computing .
- To know the wireless communication and networking principles, that support connectivity to cellular networks, wireless internet and sensor devices.
- To understand positioning techniques and location-based services and security issues .

Course Outcome(s):
CO1 To analyse the working of modern communication technologies
CO2 To demonstrate the various routing algorithms for both infrastructures based and ad hoc networks
CO3 To develop mobility and bandwidth management in cellular network
CO4 To analyse and build an energy efficient and secure mobile computing environment using heterogeneous wireless technologies
CO5 To identify the technical issues related to recent mobile computing environment

Course Contents:

Module 1: Introduction [6L]
Evolution of different types of wireless communication devices; Effects of mobility of devices; Cellular mobile networks – mobility management (call setup, handoff, interoperability and internetworking), bandwidth management, energy management, security; Brief introduction about different generations of wireless communication technology – 1G, 2G, 3G, 4G, 5G.

Module 2: Mobile Data Communication [5L]
Mobile Data Communication, WLANs (Wireless LANs) IEEE 802.11 standard, Bluetooth technology, Bluetooth Protocols, Ad hoc networks initialization, leader election, location identification, communication protocols, energy and security.

Module 3: Mobility Management in Cellular Networks [4L]
Call setup in PLMN (location update, paging), GPRS, Call setup in mobile IP networks; Handoff management; Mobility models- random walk, random waypoint, map-based, group-based.

Module 4: Bandwidth Management in Cellular Mobile networks [3L]
Mathematical formulation of the channel assignment problem (CAP); CAP and generalized graph coloring; Benchmark instances; Lower bound on bandwidth.

Module 5: Localization of Nodes in a Mobile Network [4L]
Different approaches, Indoor and outdoor localizations, LOS and NLOS signals, Outdoor localization techniques – triangulation (TOA-based, AOA- based), errors due to inaccuracies in coordinates of beacon nodes and in measurements.

Module 6: Message Communication in Ad Hoc Networks [6L]
Collision avoidance mechanism (different schemes for a deterministic transmission schedule), collision resolution mechanism – successive partitioning approach; Time slot assignment based on location information, Point-to-point routing in ad hoc networks – proactive, reactive and hybrid approaches, different protocols - DSDV, DSR, AODV, TORA, ZRP.

Module 7: Energy-efficient Communication [3L]
Energy efficiency at various layers - Physical layer, MAC layer, Network layer, Application layer, performance analysis in noisy channel environment.

Module 8: Secure Wireless Communication [4L]
Introduction-different types of attacks, internal attacks, external attacks; measures against attacks (authentication, intrusion detection, encryption); RC4 algorithm.

Textbooks:
1. K. Sinha, S.Ghosh and B. P. Sinha, Wireless Networks and Mobile Computing. CRC Press : New York, 2015.

Recommended books:
1. Research articles published on secure wireless communication (authentication, mitigation of DoS, DDoS, eavesdropping) published in leading journals.
2. Mark Ciampa, Guide to Designing and Implementing wireless LANs, Thomson learning, Vikas Publishing House, 2001.

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	2	-	3	2	-	-	-	-	-	-
CO2	2	3	3	-	3	1	-	-	-	-	-	-
CO3	3	-	2	3	3	-	-	-	-	-	-	-
CO4	3	3	2	2	2	1	-	-	-	-	-	-
CO5	3	3	3	3	3	2	-	-	-	-	-	-

Name of the Paper: Bio -informatics
Paper Code: CS801B
Contact (Periods/Week): L-T-P=3-0-0
Credit Point: 3
No. of Lectures: 35

Course Objective(s):

- To familiar with the Bio-modeling techniques
- To Learn microarray analysis
- To Understand the Pattern Matching and Visualization

Course Outcome(s):

CO1 To acquire the knowledge of Bioinformatics technologies with the related concept of DNA, RNA and their implications
CO2 To develop idea in MOLECULAR BIOLOGY
CO3 To understand the concept and techniques of different types of Data Organization and Sequence Databases with different types of Analysis Tools for Sequence Data Banks.
CO4 To acquire the knowledge of the DNA SEQUENCE ANALYSIS
CO5 To analyse the performance of different types of Probabilistic models used in Computational Biology

Course Contents:

Module -1: **Introduction to Molecular Biology[7L]**
Concepts of Cell, tissue, types of cell, components of cell, organelle. Functions of different organelles.
Concepts of DNA: Basic Structure of DNA; Double Helix structure; Watson and crick model. Exons and Introns and Gene Concept.
Concepts of RNA : Basic structure, Difference between RNA and DNA. Types of RNA.
Concept of Protein: Basic components and structure. Introduction to Central Dogma: Transcription and Translation, Introduction to Metabolic Pathways.
Introduction to Bioinformatics. Recent challenges in Bioinformatics.

Module -2: **[10L]**
Introduction to Genomic data, Data Organization and Sequence Databases: Sequence Data Banks - Introduction to sequence data banks - protein sequence data bank. Signal peptide data bank, Nucleic acid sequence data bank - GenBank, AIDS virus sequence data bank. RRNA data bank, structural data banks - protein Data Bank (PDB), The Cambridge Structural Database (CSD) : Genome data bank - Metabolic pathway data : Microbial and Cellular Data Banks.

Introduction to MSDN (Microbial Strain Data Network):Numerical Coding Systems of Microbes, Hibridoma Data Bank Structure, Virus Information System Cell line information system; Protein Sequence Databases, DNA sequence databases. sequence database search programs like BLAST and FASTA. NCBI different modules: GenBank; OMIM, Taxonomy browser, PubMed.

Module 3: DNA Sequence Analysis [8L]
DNA Mapping and Assembly : Size of Human DNA ,Copying DNA: Polymerase Chain Reaction (PCR), Hybridization and Microarrays, Cutting DNA into Fragments, Sequencing
Secondary Structure predictions;
prediction algorithms; Chao-Fasman algorithm, Hidden-Markov model, Neural Networking.
Tertiary Structure predictions;
prediction algorithms; Chao-Fasman algorithm, Hidden-Markov model, Neural Networking.

Module -4:Introduction Probabilistic models used in Computational Biology [10L]
Probabilistic Models;Gene Regulatory Method Application of HMM in Bioinformatics :Genefinding, profile searches, multiple sequence alignment and regulatory site identification.
Applications in Biotechnology: Protein classifications, Fold libraries, Protein structure prediction: Fold recognition(threading), Protein structure predictions : Comparative modeling (Homology), Advanced topics: Protein folding, Protein-ligand interactions, Molecular Modeling& Dynamics, Drug Designing.

Textbook:
1.Yi-Ping Phoebe Chen (Ed), "BioInformatics Technologies", First Indian Reprint, Springer Verlag, 2007.

References:
1.Bryan Bergeron, "Bio Informatics Computing", Second Edition, Pearson Education, 2003.
2.Arthur M Lesk, "Introduction to Bioinformatics", Second Edition, Oxford University Press, 2005

CO PO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-	-	-	-	1	1	-	-	-	-	-
CO2	-	1	2	1	-	-	-	-	-	-	-	1
CO3	1	2	-	2	2	-	-	-	1	-	-	-
CO4	2	-	-	-	-	2	2	-	-	1	1	-
CO5	-	3	-	1	-	3	-	1	-	-	-	-

Name of the Paper: Cyber law and Security Policy
Paper Code: CS801C
Contact (Periods/Week): 3L/Week
Credit Point: 3
No. of Lectures: 35

Prerequisite:
1. Familiarity in computer Networking.
2. Basic concepts about network security.

Course Objective(s) :

- To understand, explore and acquire acritical understanding of Cyber Law.
- To learn the basics of a Cyber security
- To develop competencies fordealing withfrauds anddeceptions (Confidence Tricks, Scams)

Course Outcome(s):

CO1 To learn the social and intellectual property issues emerging from cyberspace
CO2 To acquire in depth knowledge of information technology act, security policies, and legal framework of right to privacy, data security and data protection
CO3 To develop the understanding of relationship between commerce and cyberspace
CO4 To be familiar with network security threats and countermeasures

Course Contents:

Module – 1A: Introduction of Cybercrime [7]
Cybercrime, Forgery, Hacking, Software Piracy, Computer Network intrusion
Jurisdiction to prescribe/Legislative Jurisdiction; Jurisdiction to adjudicate to enforce; Cyber Jurisdiction in Civil, Criminal & International Cases.
Module – 1B: Category of Cybercrime [5]
Criminals plan attacks, passive attack, Active attacks, cyberstalking. Unicitral Model Law, Information Technology Act.

Module – 2: Cybercrime Mobile & Wireless devices[8]
Security challenges in mobile devices, cryptographic security for mobile devices, Attacks on mobile/cell phones, Theft, Virus, Hacking. Bluetooth; Different viruses on laptop.

Module -3: Tools and Methods used in Cyber-crime[8]
Proxy servers, panword checking, Random checking, Trojan Horses and Backdoors; DOS & DDOS attacks; SQL injection: buffer over flow.Most Common Attacks, Scripts Kiddies and Packaged Defense.

Module – 4A: Phishing & Identity Theft[4]
Phising methods, ID Theft; Online identity method.
Module – 4B: Cybercrime & Cyber security[3]
Legal aspects, Indian laws, IT act, Public key certificate, Design of Cyber Security Policy of an Organization

Text Books:

1. Cyber security by Nina Gobole&SunitBelapune; Pub: Wiley India.
2. Chris Reed & John Angel, Computer Law, OUP, New York, (2007).
3. Justice Yatindra Singh, Cyber Laws, Universal Law Publishing Co, New Delhi, (2012).
4. Verma S, K, Mittal Raman, Legal Dimensions of Cyber Space, Indian Law Institute, New Delhi, (2004)

Recommended Books:

1**.** Kenneth J. Knapp, "Cyber Security and Global Information Assurance:
Threat Analysis and Response Solutions", IGI Global, 2009.
2. Jonathan Rosenoer, "Cyber law: the Law of the Internet", Springerverlag, 1997
3. Sudhir Naib, The Information Technology Act, 2005: A Handbook, OUP, New York,
4. Vasu Deva, Cyber Crimes and Law Enforcement, Commonwealth Publishers, New Delhi, (2003)
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CO PO Mapping:

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

Course: VLSI Design
Course code: CS 801D
Contracts: 3L
Credits- 3
Total: 36L

Prerequisite:
1. Analog Electronic Circuit.
2. Digital Electronic and Circuit.

Course Objective(s):

- To get clear concepts on electrical behavior of NMOS, PMOS, CMOS, BiCMOS circuits and their fabrication Procedures.
- To understand the concepts of VLSI design flow of digital systems and various tools used for VLSI circuit.
- To understand area, power and cost aspects have made silicon, the popular semiconductor material used in fabrication technology for electronics in a very wide range of applications.

Course Outcome(s):

CO1 To describe scale of integration – SSI, MSI, LSI, VLSI, Moor's Law,scaling, short channel effect, VLSI design flow, FPGA architecture and construct gate level circuit with PAL & PLA concept
CO2 To analyze CMOSinverter voltage transfer characteristics with the parameters – VIL,VIH,VOL,VOH,Vth and based on the knowledge of digital circuit design methodology like – CMOS, Pass transistor,TG,DCVSL, dynamic logic,NORA, able to construct schematicof combinational, sequential circuit,SRAM, DRAM cell using MOSFET
CO3 To calculate value of resistance of current source ,MOS diode , current of current mirror circuit , voltage of references (voltage divider , threshold voltage and band gap), emulate resistance of switch capacitor circuit , gain of switch capacitor integrator and 1st order switch capacitor filter
CO4 To calculate the value of parameters to design CMOS differential amplifier and two stage OP-AMP
CO5 To describe fabrication steps of IC and construct stick diagram & layout of CMOS inverter and basic gates based on lambda and micron design rules
CO6 To calculate gate delay, dynamic power, short circuit power and leakage power and total power consumption across CMOS inverter circuit based on the derived expression of delay and power

Course Contents:
Module1 [6L]

Introduction to VLSI Design: VLSI Design Flow, Moor's Law, Scale of Integration (SSI, MSI, LSI, VLSI, ULSI - basic idea only), Types of VLSI Chips (Analog & Digital VLSI chips, General purpose, ASIC, PLA, FPGA), Design principles (Digital VLSI - Concept of Regularity, Granularity etc), Design Domains (Behavioral, Structural, Physical), Y-Chart, Digital VLSI Design Steps.

Module2 [8L]
Micro-electronic Processes for VLSI Fabrication: Silicon Semiconductor Technology- An Overview, Wafer processing, Oxidation, Epitaxial deposition, Ion-implantation & Diffusion, Cleaning, Etching, Photolithography - Positive & Negative photo-resist
Basic CMOS Technology - (Steps in fabricating CMOS), CMOS inverter, Basic n-well CMOS process, p-well CMOS process, Twin tub process, Silicon on insulator.

Module 3 [8L]
VLSI CIRCUIT DESIGN PROCESSES: Simple Combinational Gates - NAND gate and NOR Gate using CMOS , MOS Layers, Layout Design Rule (Stick diagram with examples, Layout rules), Design Rules and Layout, 2 m CMOS Design rules for wires, Contacts and Transistors Layout Diagrams for NMOS and CMOS Inverters and Gates, Scaling of MOS circuits, Limitations of Scaling.

Module 4 [14L]
COMBINATIONAL & SEQUENTIAL CIRCUIT DESIGN USING HARDWARE DESCRIPTION LANGUAGE: Logic gates, Adders, Subtractor, Mux, Decoder, ALUs, Multipliers, Parity generators, Comparators, Zero/One Detectors, Subsystem Design, Flip-flops, Shifters, Counters, High Density Memory Elements.

Textbooks:
1. CMOS Digital Integrated Circuits: Sung-Mo Kang, Yusuf Leblebici, Mcgraw Hill Education
2. VLSI Design – Debaprasad Das, Oxford University Press
3. VLSI Technology – S.M. SZE, 2nd Edition, TMH, 2003.

References Books:
1. Chip Design for Submicron VLSI: CMOS Layout & Simulation, - John P. Uyemura, Thomson Learning.
2. Introduction to VLSI Circuits and Systems - John .P. Uyemura, JohnWiley, 2003.
3. Digital Integrated Circuits - John M. Rabaey, PHI, EEE, 1997.
4. Modern VLSI Design - Wayne Wolf, Pearson Education, 3rd Edition, 1997.
5. VLSI Technology – S.M. SZE, 2nd Edition, TMH, 2003.
6. Principles of CMOS VLSI Design - Weste and Eshraghian, Pearson Education, 1999.

CO PO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	3	1	1	-	-	1	2	1	1	1
CO2	3	3	3	3	1	-	-	1	2	1	1	3
CO3	3	3	3	2	1	-	-	1	2	1	1	3
CO4	3	3	3	1	1	-	-	1	2	1	1	3
CO5	3	3	3	1	1	-	-	1	2	1	1	3
CO6	3	3	3	2	1	-	-	1	2	1	1	2

Name of the Paper: Parallel Computing

Paper Code: CS802A
Contact (Periods/Week): 3L/Week
Credit Point: 3
No. of Lectures: 35

Prerequisite:
1. Familiarity with Operating Systems
2. A solid background in Computer Organization, Architecture and Algorithm

Course Objective(s):

- To learn the basics of parallel system and how parallel computers work.
- To learn how to analyze the correct designs of parallel architectures, especially within the technological constraints.
- To prepare students for a career in designing the computer systems of the future.

Course Outcome(s):
CO1 To explain the range of requirements that modern parallel systems have to address.
CO2 To define the functionality that parallel systems architecture must deliver to meet some need.
CO3 To articulate design tradeoffs inherent in large-scale parallel architecture and algorithms design.
CO4 To demonstrate the potential run-time problems arising from the concurrent operation of many (possibly a dynamic number of) tasks in a parallel system
CO5 To justify the presence of concurrency within the framework of a parallel system

Course Contents:

Module 1: (Introduction) [7L]
Concepts of pipelining and parallelism, Temporal vs. spatial parallelism, differences between distributed computing and parallel computing, loosely coupled vs. tightly coupled systems, Types of parallel architectures – Instruction vs. data (SIMD, MISD, MIMD) (Flynn's classification), Series vs. parallel (Feng's classification), Pipelining vs. parallelism (Haendler'sclassification). Performance measures – Speed-up factor, AT and AT2 measures, Amdahl's law,.
Models of parallel computation – Parallel RAM (PRAM) model, (EREW, CREW, CRCW models), Interconnection network based model, Interrelationship among the performances under EREW, CREW and CRCW models.
Memory interleaving - S-access and C-access organization. Concept of reservation table in multifunction static pipeline and minimum average latency. Elementary concepts of data low architecture.

Module 2: (Interconnection Networks) [9L]
Static interconnection networks – concept of network graph and the desirable features of a network graph in terms of node degree, diameter, fault-tolerance and bisection width, Different types of interconnection network - Crossbar, Clos, loop, star, wheel, double-loop, tree, mesh, torus, multi-mesh, mesh of trees, multi-mesh of trees, shuffle-exchange, pyramid, hypercube, butterfly, cube-connected cycles, Moebius network, De Bruijn network, OTIS architecture.
Dynamic interconnection networks – concept of blocking, non-blocking and re-arrangeable networks, Baseline, Omega and Benes networks.

Module 3: (Parallel Arithmetic) [10L]
Addition/Subtraction - Addition of two n-bit numbers in O(log n) time with O(n log n) logic gates using precarry addition, carry-propagation free addition in redundant binary number system.

Multiplication – Dadda's generalized multiplier, column compression technique, parallel algorithm for multiplying two n-bit signed integers in O(log n) time, parallel multiplication in redundant binary and quarternary number systems.
Division : O(log 2 n) division algorithm using repeated multiplications and additions. Parallel algorithm for prefix sum computation on different architectures.
Matrix transpose : O(n) algorithm on a mesh architecture, O(log n) algorithm on a shuffleexchange network.
Matrix multiplication : parallel algorithms for multiplying two n x n matrices in O(n2), time, O(n log n) time, O(n) time, O(log n) time and O(1) time on appropriate parallel architectures, matrix by vector computation.

Module 4: (Numerical Problems) [4L]
Solution of simultaneous linear equations: parallel algorithm based on Gauss-Jordan elimination; parallel algorithm based on Gauss-Seidel iteration. Finding roots of a polynomial equation: parallel algorithms based on bisection method and Newton-Raphson method.

Module 5: (Sorting and Searching) [5L]
Odd-even transposition sort, sorting networks, 0-1 principle, Batcher's odd-even merge sort, Batcher's bitonic sort, sorting n2 elements in O(n) time on a 2-D mesh, brief discussion on sorting n4 elements in O(n) time a on a multi-mesh. Parallel algorithms for searching.

Textbooks:
1. Design and Analysis of Parallel Algorithms- Selim G. Akl, Prentice Hall.
2. Computer Architecture and Parallel Processing – Kai Hwang and F. A. Briggs, McGraw-Hill.

Recommended books:
1. Parallel Computing –Theory and Practice -Michael J. Quinn. McGraw-Hill.
2. The Art of Computer Programming Vol. 3 (Sorting and Searching) – Donald E. Knuth, Addison-Wesley.

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	3	3	2	3	-	1	-	1	1	-	2
CO2	3	2	3	3	2	-	1	-	1	1	-	2
CO3	3	3	3	3	2	-	1	-	1	1	-	2
CO4	2	3	3	3	3	-	1	-	1	1	-	2
CO5	2	3	2	3	2	-	1	-	1	1	-	2

Name of the Paper: Machine Learning
Paper Code: CS802B
Contact (Periods/Week): 3L/Week

Credit Point: 3
No. of Lectures: 35

Prerequisite:
1. Basic programming skills
2. Algorithm design
3. Fundamental knowledge of probability and statistics

Course Objective(s)
- To be able to formulate machine learning problems corresponding to different applications.
- To understand a range of machine learning algorithms along with their strengths and weaknesses
- To understand the basic theory underlying machine learning
- To be able to apply machine learning algorithms to solve problems of moderate complexity.
- To be able to read current research papers and understand the issues raised by current research.

Course Outcome(s):
CO1 To have a good understanding of the fundamental issues and challenges of machine learning: data, model selection, model complexity, etc.
CO2 To have an understanding of the strengths and weaknesses of many popular machine learning approaches
CO3 To appreciate the underlying mathematical relationships within and across Machine Learning algorithms and the paradigms of supervised, un-supervised learning and reinforcement learning
CO4 To design and implement various machine learning algorithms in a range of real-world applications.

Course Contents:
Module1: Introduction [3L]
Applications and problems, learning scenarios, concepts of tasks (problems to be solved by machine learning), models (output of machine learning) and features (workhorses of machine learning). geometric models, probabilistic models, logical models.

Module 2: Classification Schemes [5L]
Binary classification, assessing and visualizing performance of classification, scoring and ranking, turning rankers into classifiers, class probability estimation. [3L]
Multiclass classification, multiclass scores and probabilities, regression, unsupervised and descriptive learning, predictive and descriptive clustering.[2L]

Module 3: Various Models [15L]
Tree Models [3L]
Decision trees, ranking and probability estimation trees, tree learning as variance reduction, regression trees. [3L]
Rule Models [2L]
Learning ordered rule lists, learning unordered rule sets, descriptive rule learning, rule learning for subgroup discovery, association rule mining, first-order rule learning. [2L]
Linear Models [4L]
Least squares method, multivariate linear regression, regularized regression. [1L]

Perceptron, support vector machine, soft margin SVM, probabilities from linear classifiers, beyond linearity with kernel methods.[3L]

Distance-based Models [3L]

Nearest neighbour classification, distance-based clustering, K-means algorithm, clustering around medoids. Hierarchical clustering.[3L]

Probabilistic Models [3L]

Normal distribution, probabilistic models for categorical data, naïve Bayes model for classification, probabilistic models with hidden variables, Gaussian mixture model, compression-based model.[3L]

Module 4 : Features [4L]

Types of features, calculation on features, categorical, ordinal and quantitative features, structured features, thresholding and discretization, normalization and calibration, incomplete features, feature selection - matrix transformations and decompositions. [4L]

Module 5: Model Ensembles and Machine Learning Experiments [4L]

Model Ensembles [2L]

Bagging and random forests, boosted rule learning, mapping the ensemble landscape – bias, variance and margins, meta learning. [2L]

Machine Learning Experiments [2L]

What to measure, how to measure, how to interpret, interpretation of results over multiple data set. [2L]

Module 6 : More Selected Topics in Machine Learning [4L]

Support vector machines – separable and unseparable cases, primal optimization and dual optimization problems, kernel methods – positive definite symmetric kernels and negative definite symmetric kernels, kernel-based algorithms. [4L]

Textbook:

1.Peter Flach, Machine Learning. Cambridge University Press, 2012.

Reference Books:

1.M. Mohri, A. Rostamizadeh and A. Talwalkar, Foundations of Machine Learning, MIT Press, 2012.
2.Kevin P. Murphy, Machine Learning : A Probabilistic Perspective. MIT Press, 2012.

CO-PO Mapping

CO	PO1	PO2	POP3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12

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

Course Name: Real Time Operating System and Embedded system
Course Code: CS802C
Total Contact Hours:36
Credit:3

Prerequisites:
1. Concepts of Operating systems and Algorithm.
2. Knowledge of Distributed System basics.

Course Objective(s):

- To understand the real-time systems
- To learn computing required for the real-time embedded systems
- To understand the communication required for the real-time embedded systems

Course Outcome(s):

CO1 To describing the fundamental concepts of RTOS and Embedded System
CO2 To developing programs for real time services, firmware and RTOS
CO3 To develop programs for multithreaded applications on FreeRTOS
CO4 To design the Embedded System

Course Contents:

Module 1: Real time systems and Resources [10]

Real-Time Systems and Resources[4]: Brief history of Real Time Systems, A brief history of Embedded Systems, Requirements of Embedded System, Challenges in Embedded System. System Resources, Resource Analysis, Real-Time Service Utility.

Processing with Real Time Scheduling [6]: Scheduler Classes, Preemptive Fixed Priority Scheduling Policies with timing diagrams, Rate Monotonic least upper bound, Necessary and sufficient feasibility, Deadline – Monotonic Policy, Dynamic priority policies, Worst case execution time, Deadlock and lovelock.

Module 2: Real Time Operating Systems [8]

Operating System basics, The Kernel and its subsystems, Kernel Space and User Space, Kernel Architecture, Types of operating system, Task, process and Threads, Multi-Processing and

Multitasking, Types of multitasking, Task Scheduling, Task states, Non-Preemptive scheduling, Preemptive Scheduling, Round Robin Scheduling, Idle Task, Task Communication, Task Synchronization, Thread Safe Reentrant Functions.

Module 3: Embedded Firmware Design [10]

Embedded Firmware Design, development and Free RTOS: Embedded Firmware Design Approaches, Super-loop based approach, Embedded Operating System based approach, Programming in Embedded C, Integrated development environment (IDE), Overview of IDEs for Embedded System Development.[6]

FreeRTOS: Introduction to FreeRTOS , multitasking on an LPC17xx Cortex-M3 Microcontroller, LPC17xx Port of FreeRTOS, Resources Used by FreeRTOS, Task Management, Task Functions, Task Priorities, Idle task and task hook function, Creation and Deletion of tasks.[4L]

Module 4: Embedded System Design with RTOS [6]

Queue Management, Characteristics of a Queue, Working with Large Data, Interrupt Management, and Queues within an Interrupt Service Routine, Critical Sections and Suspending the Scheduler, Resource Management, Memory Management.

Case Studies:

Commercial RTOS - µC/OS, VxWorks, Linux POSIX system, RTLinux / RTAI, Windows system, Vxworksetc.[2]

Textbooks:

1. Sam Siewert , "Real-Time Embedded Systems And Components".
2. Shibu K V, "Introduction to Embedded System".

Reference books:

1. "Using the FreeRTOS Real Time Kernel" From FreeRTOS.
2. Manuals and Technical Documents from the ARM Inc, web site.

CO-PO Mapping

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

Name of the Paper: Advanced Computer Architecture
Paper Code: CS802D
Contact (Periods/Week):3L/Week
Credit Point: 3

No. of Lectures: 35

Prerequisite:
1. Familiarity with the functionalities of basic digital computer system.
2. Fundamentals of Computer Architecture.

Course Objective(s):
- To understand the Concept of Parallel Processing and its applications
- To implement the Hardware for Arithmetic Operations
- To analyze the performance of different scalar Computers
- To understand the Pipelining Concept for a given set of Instructions
- To learn the performance of pipelining and non-pipelining environment in a processor

Course Outcomes(s) :
CO1 To acquire the knowledge of parallelism and pipelining
CO2 To develop knowledge of parallel processing
CO3 To combine the concept and design techniques of interconnection network
CO4 To acquire the knowledge of shared memory architecture
CO5 To describe the fundamentals of embedded system architecture

Module 1: Introduction to Advanced Computer Architectures [5L]
Different types of architectural classifications – instruction vs. data (SISD, SIMD, MISD, MIMD), serial vs. parallel, pipelining vs. parallelism; Pipelining: Definition, different types of pipelining, hazards in pipelining.
Concept of reservation tables, issue of multiple instructions with minimum average latency (MAL).

Module2: Parallel Processing & ILP[8L]
RISC architecture, characteristics of RISC instruction set & RISC pipeline, its comparisons with CISC,necessity of using optimizing compilers with RISC architecture, Review of instruction-level parallelism-Super pipelining, Superscalar architecture, Diversified pipelines and out of order execution, VLIW architecture, Dataflow and Control Flow Architectures, Loop Parallelization

Module 3: Interconnection Networks[13L]
Desirable properties of interconnection networks, static interconnection networks – path, cycle, double-loop, star, wheel, 2D mesh and its variants, multi-mesh, tree, shuffle-exchange, cube, cube-connected cycles
Dynamic interconnection networks: concepts of blocking, rearrangeable and blocking but rearrangeable networks, various types of multistage interconnection networks (MIN)- crossbar, clos, baseline, omega, Benes.

Module 4: Shared Memory Architecture [4L]
Fundamentals of UMA, NUMA, NORMA,COMA architectures, Performance measurement for parallel architectures –Amadahl’s law, Gustafson's law

Module 5: Embedded System Architecture [5L]
Definition, Example, Classification ofEmbedded system, Embedded System Design Issues: Hardware issues (Processor, Memory, Peripherals) ,Softwareissues (Programming Languages, Time Criticality, RTOS)

Text Books

1. J. L. Hennessey and D. A. Patterson: Computer Architecture: A Quantitative Approach, 5th edition, Morgan Kaufmann, 2012.
2. K. Hwang and F. A. Briggs: Computer Architecture and Parallel Processing, Tata McGraw Hill, New Delhi.

Reference Books

1. Tse-yun Feng, A Survey of Interconnection Networks, IEEE, 1981.
2. Selim G. Akl, The Design and Analysis of Parallel Algorithms, Prentice-Hall, 1989.
3. Raj Kamal, Embedded Systems Architectures Programming and Design, Second Edition The MacGraw-Hill(for Embedded System) .

CO-PO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-	-	-	-	-	-	-	-	-	-	-
CO2	3	3	1	-	-	-	-	-	-	-	-	-
CO3	3	3	3	2	3	-	-	-	-	-	-	-
CO4	3	3	3	2	3	-	-	-	-	-	-	-
CO5	3	2	2	2	2	-	-	-	-	-	-	-

Name of the Paper: Web Technology Lab
Paper Code: CS792C
Contact (Periods/Week): 3P/Week
Credit Point: 2
No. of Lectures: 30

Prerequisite:
Fundamentals of Programming

Course Objective(s):

- To impart the design, development and implementation of Static and Dynamic Web Pages
- To develop programs for Web using Scripting Languages and .net framework
- To give an overview of Server Side Programming in Web

Course Outcome(s):

CO1 To develop interactive web pages using HTML, DHTML, CSS and image map
CO2 To procure the knowledge of information interchange formats like XML
CO3 To validate fields of web pages using scripting languages like JavaScript
CO4 To develop web applications using PHP and ASP.net
CO5 To acquire the server side programming concepts using servlet, JSP

CO-PO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	-	2	-	-	-	-	-	-	-	-	-

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

List of Experiments:

1. Write a single html program through which you can explain a) anchor tag, b)'img' tag with 'src' attribute, c)paragraph d) heading.

2. Write a single html program through which you can draw a table which consists of 3 row and 4 columns where 1st row contains 4 different column fields of a student's information with red text color and Calibri font style with font 12. Rest cells of whole table contain values with blue text colors and Times new roman font style with font 10.

3. Write a single html program where 1st paragraph can collect its specified style from internal stylesheet describes inside that html program and 2nd paragraph can collect its specified style from another file (external stylesheet).

4. Write a single html program which implements image map concept using 'usemap' and <map>.

5. Write a html program to find out Celsius temperature of a given Fahrenheit temperature using JavaScript.

6. Write a html program to find out m to the power n (m, n valid integer no) using a function using javascript.

7. Write a xml parsing technique through which parse a text string into an XML DOM object, and extracts the info from it with JavaScript.

8. Write a simple php program through which you can find out maximum and minimum among three no's specified by the user.

9. Write a simple php program through which you can implement the concept of GET & POST method w.r.t PHP Form handling.

10. Write a simple program in ASP.net through which you can create a login page of your own website.

11. Write a simple JSP program through which you can print even and odd no separately within a given range.

12. Create a Online Registration form for individual user of an website using Servlet.

Textbooks:

1. "Web Technology: A Developer's Perspective", N.P. Gopalan and J. Akilandeswari, PHI Learning, Delhi, 2013. **(Topics covered: html, CSS, imagemap, xml)**

2. “Learning PHP, MySQL & JavaScript”, Robin Nixon, O’Reilly Publication.(**Topics covered: PHP, Java Script)**
3. “Head First Servlet’s & JSP”, Bryan Basham, Kathy Sterra, Bert Bates, O’Reilly Publication.(**Topics covered: Servlet, JSP)**
4. ASP.NET Core 2.0 MVC And Razor Pages For Beginners:” Jonas Frajerberg, O’Reilly Publication.(**Topics covered: MVC, ASP.Net, C#)**

Recommended books:

1. "Programming the World Wide Web", Robert. W. Sebesta, Fourth Edition, Pearson Education, 2007.
2. ”Core Web Programming”- Second Edition-Volume I and II, Marty Hall and Larry Brown, Pearson Education, 2001.
3. “Web Technologies”, Black Book, Dreamtech Press