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## Credit Definition

| Type | Duration (in Hour) | Credit |
|---|---|---|
| Lecture (L) | 1 | 1 |
| Tutorial (T) | 1 | 1 |
| Practical (P) | 2 | 1 |

## Total Credit

| Year | Semester | hrs./Week | Credit |
|---|---|---|---|
| 1st | 1st | 30 | 25 |
| | 2nd | 30 | 25 |
| 2nd | 3rd | 25 | 23 |
| | 4th | 25 | 23 |
| 3rd | 5th | 23 | 21 |
| | 6th | 20 | 20 |
| 4th | 7th | 20 | 18 |
| | 8th | 19 | 17 |
| **Total** | | | **172** |

## Category Codification with Credit Break up

| Definition of Category | Code | No | Credit |
|---|---|---|---|
| Basic Science | BS | 1 | 25 |
| Engineering Science | ES | 2 | 24 |
| Professional Core | PC | 3 | 48 |
| Professional Elective (Discipline Specific) | PE | 4 | 17 |
| Open Elective (General Elective) | OE | 5 | 16 |
| Humanities & Social Science including Management | HSM | 6 | 10 |
| Project Work / Seminar / Internship / Entrepreneurship | PSE | 7 | 20 |
| Mandatory / University Specified (Environmental Sc. / Induction Training / Indian Constitution / Foreign language) | MUS | 8 | 12 |
| **Total** | | | **172** |

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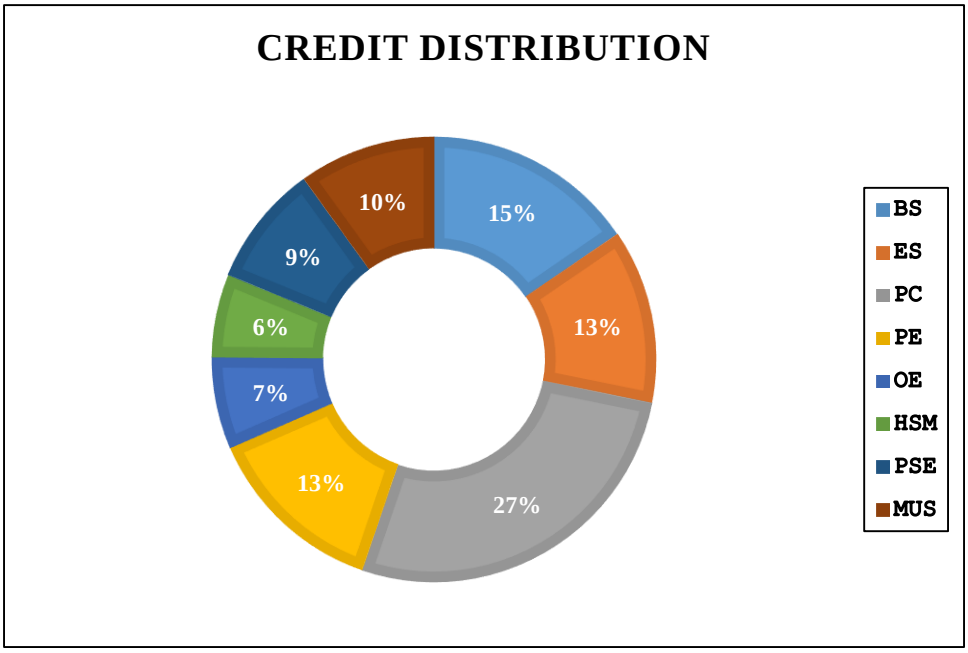
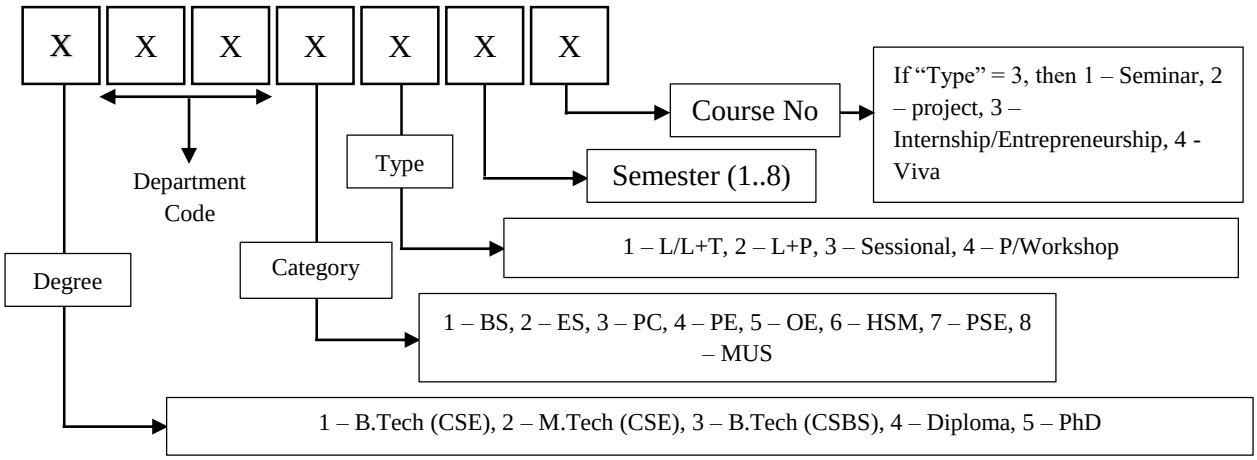
## Category wise Credit Distribution




## Subject Codification



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## SEMESTER: I

**Mandatory Induction Program – Duration 3 weeks**

- Physical Activity
- Creative Arts
- Universal Human Values
- Literary
- Proficiency Modules
- Lectures by Eminent People
- Visits to Local Areas
- Familiarization to Department/Branch & Innovations

| Sl No | Course Title | Code | Credit | Type | | |
|---|---|---|---|---|---|---|
| | | | | L | T | P |
| 1 | Engineering Mathematics – I | 1191111 | 3 | 3 | 0 | 0 |
| 2 | Engineering Physics | 1171112 | 3 | 3 | 0 | 0 |
| 3 | Engineering Drawing | 1102111 | 2 | 2 | 0 | 0 |
| 4 | Fundamentals of Computer Sc. & Problem-Solving | 1112112 | 3 | 3 | 0 | 0 |
| 5 | Principles of Electrical Engineering | 1132113 | 3 | 3 | 0 | 0 |
| 6 | Communicative English - I | 1216111 | 2 | 2 | 0 | 0 |
| 7 | Environmental Science | 1158111 | 2 | 2 | 0 | 0 |
| 8 | Engineering Physics Lab | 1171212 | 1 | 0 | 0 | 2 |
| 9 | Engineering Drawing | 1102211 | 1 | 0 | 0 | 2 |
| 10 | Python Lab | 1112212 | 2 | 0 | 0 | 4 |
| 11 | Principles of Electrical Engineering Lab | 1132213 | 1 | 0 | 0 | 2 |
| 12 | Foreign Language - I | 1278131 | 2 | 2 | 0 | 0 |
| **Total Credit (BS: 07, ES: 12, HSM: 02, MUS: 02)** | | | **25** | **30 (hrs./Week)** | | |

## SEMESTER: II

| Sl No | Course Title | Code | Credit | Type | | |
|---|---|---|---|---|---|---|
| | | | | L | T | P |
| 1 | Engineering Mathematics – II | 1191121 | 3 | 3 | 0 | 0 |
| 2 | Engineering Chemistry | 1161122 | 3 | 3 | 0 | 0 |
| 3 | Introduction to Manufacturing Processes | 1102121 | 2 | 2 | 0 | 0 |
| 4 | Principles of Computer Programming | 1112122 | 3 | 3 | 0 | 0 |
| 5 | Basic Electronics | 1122123 | 3 | 3 | 0 | 0 |
| 6 | Biology for Engineers | 1151123 | 2 | 2 | 0 | 0 |
| 7 | Communicative English - II | 1216121 | 2 | 2 | 0 | 0 |
| 8 | Engineering Chemistry Lab | 1161222 | 1 | 0 | 0 | 2 |
| 9 | Introduction to Manufacturing Processes Lab | 1102221 | 1 | 0 | 0 | 2 |
| 10 | C Programming Lab | 1112222 | 2 | 0 | 0 | 4 |
| 11 | Basic Electronics Lab | 1122223 | 1 | 0 | 0 | 2 |

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| | | | | | | |
|---|---|---|---|---|---|---|
| 12 | Foreign Language - II | 1278141 | 2 | 2 | 0 | 0 |
| **Total Credit (BS: 09, ES: 12, HSM: 02)** | | | **25** | **30 (hrs./Week)** | | |

## SEMESTER: III

| Sl No | Course Title | Code | Credit | Type | | |
|---|---|---|---|---|---|---|
| | | | | L | T | P |
| 1 | Engineering Mathematics – III | 1191131 | 3 | 3 | 0 | 0 |
| 2 | Data Structure & Algorithm | 1113131 | 4 | 3 | 1 | 0 |
| 3 | Object-Oriented Programming | 1113132 | 3 | 3 | 0 | 0 |
| 4 | Computer Organization and Architecture | 1113133 | 4 | 3 | 1 | 0 |
| 5 | Formal Language and Automata Theory | 1113134 | 3 | 3 | 0 | 0 |
| 6 | Foreign Language - III | 1278151 | 2 | 2 | 0 | 0 |
| 7 | Mentored Seminar – I | 1117331 | 1 | | | |
| 8 | Data Structure & Algorithm Lab | 1113231 | 1 | 0 | 0 | 2 |
| 9 | Object-Oriented Programming Lab | 1113232 | 1 | 0 | 0 | 2 |
| 10 | Computer Organization and Architecture Lab | 1113233 | 1 | 0 | 0 | 2 |
| **Total Credit (BS: 03, PC: 17, PSE: 01, MUS: 02)** | | | **23** | **25 ( hrs./Week)** | | |

## SEMESTER: IV

| Sl No | Course Title | Code | Credit | Type | | |
|---|---|---|---|---|---|---|
| | | | | L | T | P |
| 1 | Engineering Mathematics – IV | 1191141 | 3 | 3 | 0 | 0 |
| 2 | Operating Systems | 1113141 | 3 | 3 | 0 | 0 |
| 3 | Design and Analysis of Algorithm | 1113142 | 4 | 3 | 1 | 0 |
| 4 | Database Management System | 1113143 | 4 | 3 | 1 | 0 |
| 5 | Financial Management & Economics for Engineers | 1246141 | 3 | 3 | 0 | 0 |
| 6 | Foreign Language - IV | 1278161 | 2 | 2 | 0 | 0 |
| 7 | Mentored Seminar – II | 1117341 | 1 | | | |
| 8 | Operating Systems Lab | 1113241 | 1 | 0 | 0 | 2 |
| 9 | Design and Analysis of Algorithm Lab | 1113242 | 1 | 0 | 0 | 2 |
| 10 | Database Management System Lab | 1113243 | 1 | 0 | 0 | 2 |
| **Total Credit (BS: 03, PC: 14, PSE: 01, MUS: 02, HSE: 03)** | | | **23** | **25 ( hrs./Week)** | | |

## SEMESTER: V

| Sl No | Course Title | Code | Credit | Type | | |
|---|---|---|---|---|---|---|
| | | | | L | T | P |
| 1 | Engineering Mathematics – V | 1191151 | 3 | 3 | 0 | 0 |
| 2 | Artificial Intelligence | 1113151 | 3 | 3 | 0 | 0 |
| 3 | Software Engineering | 1113152 | 4 | 3 | 1 | 0 |
| 4 | Compiler Design | 1113153 | 3 | 3 | 0 | 0 |
| 5 | Elective-I (Open) | 1**5151 | 4 | 3 | 1 | 0 |
| 6 | Mentored Seminar – III | 1117351 | 1 | | | |

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| Sl No | Course Title | Code | Credit | Type | | |
|---|---|---|---|---|---|---|
| | | | | L | T | P |
| 7 | Artificial Intelligence Lab | 1113251 | 1 | 0 | 0 | 2 |
| 8 | Software Engineering Lab | 1113252 | 1 | 0 | 0 | 2 |
| 9 | Compiler Design Lab | 1113253 | 1 | 0 | 0 | 2 |
| **Total Credit (BS:03, PC: 13, OE: 04, PSE: 01, MUS: 02)** | | | **21** | **23 ( hrs./Week)** | | |

| **Elective I (Open)** | | |
|---|---|---|
| **Sl No.** | **Paper Code** | **Paper Name** |
| 1. | 1**5151A | Microprocessor and Microcontroller |
| 2. | 1**5151B | Analog and Digital Communication |

## SEMESTER: VI

| Sl No | Course Title | Code | Credit | Type | | |
|---|---|---|---|---|---|---|
| | | | | L | T | P |
| 1 | Project Management and Entrepreneurship Skill | 1246161 | 3 | 3 | 0 | 0 |
| 2 | Computer Networks | 1113161 | 3 | 3 | 0 | 0 |
| 3 | Elective – II (Open) | 1**5161 | 4 | 3 | 1 | 0 |
| 4 | Elective – I (Professional) | 1114161 | 3 | 3 | 0 | 0 |
| 5 | Elective – II (Professional) | 1114162 | 3 | 3 | 0 | 0 |
| 6 | Mentored Seminar – IV | 1117361 | 2 | | | |
| 7 | Computer Networks Lab | 1113261 | 1 | 0 | 0 | 2 |
| 8 | Elective – II (Professional) Lab | 1114262 | 1 | 0 | 0 | 2 |
| **Total Credit (HSM:03, PC: 04, PE: 07, OE: 04, PSE: 02 MUS: 02)** | | | **20** | **20 ( hrs./Week)** | | |

| **Elective II (Open)** | | |
|---|---|---|
| **Sl No.** | **Paper Code** | **Paper Name** |
| 1. | 1**5161A | Fuzzy Set Theory And Decision Making |
| 2. | 1**5161B | Robotics |
| **Elective – I (Professional)** | | |
| **Sl No.** | **Paper Code** | **Paper Name** |
| 3. | 1114161A | Digital Signal Processing |
| 4. | 1114161B | Cryptography and Network Security |
| 5. | 1114161C | Advanced Architecture |
| 6. | 1114161D | Artificial Neural Network |
| **Elective – II (Professional)** | | |
| 7. | 1114162A | Digital Image Processing |
| 8. | 1114162B | Embedded System |
| 9. | 1114162C | Machine Learning |

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## SEMESTER: VII

| Sl No | Course Title | Code | Credit | Type | | |
|---|---|---|---|---|---|---|
| | | | | L | T | P |
| 1 | Elective-III (Open) | 1**5171 | 4 | 3 | 1 | 0 |
| 2 | Elective- III (Professional) | 1114171 | 3 | 3 | 0 | 0 |
| 3 | Elective- IV (Professional) | 1114172 | 3 | 3 | 0 | 0 |
| 4 | Project – I | 1117372 | 3 | 0 | 0 | 6 |
| 5 | Constitution of India | 1238171 | 2 | 2 | 0 | 0 |
| 6 | Elective- IV (Professional) Lab | 1114272 | 1 | 0 | 0 | 2 |
| 7 | Summer Training | 1117373 | 2 | | | |
| **Total Credit (PE: 07, OE: 04, PSE: 05, MUS:02)** | | | **18** | **20 ( hrs./Week)** | | |

| **Elective III (Open)** | | |
|---|---|---|
| **Sl No.** | **Paper Code** | **Paper Name** |
| 1. | 1**5171A | Fiber Optic communication |
| 2. | 1**5171B | Cyber Law |
| 3. | 1**5171C | Web Technology |
| **Elective – III (Professional)** | | |
| **Sl No.** | **Paper Code** | **Paper Name** |
| 4. | 1114171A | Bioinformatics |
| 5. | 1114171B | Cloud Computing |
| 6. | 1114171C | Data Mining |
| 7. | 1114171D | Internet of Things |
| **Elective – IV (Professional)** | | |
| 8. | 1114172A | Soft Computing |
| 9. | 1114172B | Natural Language Processing |
| 10. | 1114172C | Distributed System |

## SEMESTER: VIII

| Sl No | Course Title | Code | Credit | Type | | |
|---|---|---|---|---|---|---|
| | | | | L | T | P |
| 1 | Elective- IV (Open) | 1**5181 | 4 | 3 | 1 | 0 |
| 2 | Elective- V (Professional) | 1114181 | 3 | 3 | 0 | 0 |
| 3 | Project-II | 1117382 | 6 | 0 | 0 | 12 |
| 4 | Comprehensive Viva | 1117384 | 4 | | | |
| **Total Credit (PE: 03, OE: 04, PSE: 10)** | | | **17** | **19 ( hrs./Week)** | | |

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| **Elective IV (Open)** | | |
|---|---|---|
| **Sl No.** | **Paper Code** | **Paper Name** |
| 1. | 1**5181A | Data Analytics |
| 2. | 1**5181B | Industrial Psychology |
| **Elective- V (Professional)** | | |
| **Sl No.** | **Paper Code** | **Paper Name** |
| 3. | 1114181A | Data Science |
| 4. | 1114181B | Wireless and Sensor Network |
| 5. | 1114181C | Mobile Computing |
| 6. | 1114181D | Block Chain and Crypto Currency |

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# DETAILED SYLLABUS

## Engineering Mathematics - I

## COURSE INFORMATION:

| | |
|---|---|
| **SCHOOL :** Engineering & Technology | **COURSE TYPE:** L-T-P |
| **NAME:** Engineering Mathematics – I | **COURSE CREDIT :** 03 [3-0-0] |
| **DEPARTMENT:** Mathematics | **CATEGORY:** BS |
| **CODE:** 1191111 | **SEMESTER:** First |
| **PRE-REQUISITE (If Any):** | |

## SYLLABUS OUTLINE:

**Differential Calculus:** Functions of one variable Rolle's theorem, Mean value theorem, Taylor series expansion, concavity and convexity of a curve, points of inflexion, asymptotes and curvature, curve tracing.
**Function of several variables:** Limit, continuity and differentiability of functions of several variables, partial derivatives and their Geometrical interpretation, differential, derivatives of composite and implicit functions, derivatives of higher order and their commutatively, Euler's theorem on homogeneous function, harmonic functions, Taylor's expansion of functions of several variables, Maxima and Minima of functions of several variables- Lagrange's method of multipliers.

**Integral Calculus:** Review of integration and definite integral. Definite integral as the limit of sum, applications of definite integrals, double and triple integral, area under plane curve, improper integral.

**Differential Equations:** Order, degree, formation of differential equation, First order differential equation – exact, linear and Bernoulli's form, second order differential equations with constant coefficients, method of variation of parameters, general linear differential equations with constant coefficients, Euler's equations, system of differential equations. Applications.

**Sequences and Series:** Sequences and their limits, convergence of series, comparison test, Ratio test, Root test, Absolute and conditional convergence, alternating series, Power series.

**Text Books:**

1. Higher Algebra, S. K. Mapa, Levant Books.
2. Advanced Higher Algebra, Chakravorty and Ghosh, U N Dhar Pvt. Ltd.ISBN 97893806736
3. Integral Calculus including Differential Equations, Das and Mukherjee, U N Dhar Pvt. Ltd.ISBN: 978-9380673882

4. Differential Calculus, Das and Mukherjee, U N Dhar Pvt. Ltd. ISBN:9789380673448.

**Reference Books:**

5. Advanced Engineering Mathematics, E Kreyszig, Wiley
6. Ghosh and Maity, An Introduction to Analysis: Differential Calculus, New Central Book Agency, 2011, ISBN: 9788173812026
7. G.F. Simmons, Differential Equations with applications and Historical Notes, CRC Press ISBN: 978-1-4987-0259-1
8. M.D. Raisinghania, Ordinary and Partial Differential Equation, S. Chand and Company, 2006 ISBN 81-219-0892-2
9. Schaum's Outline of Differential Equations, 4th Edition (Schaum's Outlines) by Richard Bronson and Gabriel Costa.

## Engineering Physics

## COURSE INFORMATION:

| | |
|---|---|
| **SCHOOL :** Engineering & Technology | **COURSE TYPE:** L-T-P |
| **NAME:** Engineering Physics | **COURSE CREDIT :** 03 [3-0-0] |
| **DEPARTMENT:** Physics | **CATEGORY:** BS |
| **CODE:** 1171112 | **SEMESTER:** First |
| **PRE-REQUISITE (If Any):** | |

## SYLLABUS OUTLINE:

**Oscillation and fundamental of wave optics:** Periodic motion-simple harmonic motion-characteristics of simple harmonic motion-vibration of simple springs mass system. Resonance-definition., damped harmonic oscillator – heavy, critical and light damping, energy decay in a damped harmonic oscillator, quality factor, forced mechanical and electrical oscillators.

**Interference-principle of superposition-young's experiment:** Theory of interference fringes-types of Interference-Fresnel's Prism-Newton's rings, Diffraction-Two kinds of Diffraction-Difference between interference and Diffraction-Fresnel's half period zone and zone plate-Fraunhofer diffraction at single slit-plane diffraction grating. Temporal and Spatial Coherence.

**Basic Idea of Electromagnetisms, Maxwell's Equations:** Polarization - Concept of production of polarized beam of light from two SHM acting at right angle; plane, elliptical and circularly polarized light, Brewster's law, double refraction.

**Quantum Mechanics and Crystallography:** Introduction - Planck's quantum theory- Matter waves, de-Broglie wavelength, Heisenberg's Uncertainty principle, time independent and time dependent Schrödinger's wave equation, Physical significance of wave function, Particle in a one dimensional potential box, Heisenberg Picture.

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Crystallography - Basic terms-types of crystal systems, Bravais lattices, miller indices, d spacing, Debye Scherrer powder method, laue method- Atomic packing factor for SC, BCC, FCC and HCP structures. Semiconductor Physics - conductor, semiconductor and Insulator; Basic concept of Band theory.

**Laser and Fiber optics:** Einstein's theory of matter radiation interaction and A and B coefficients; amplification of light by population inversion, different types of lasers: Ruby Laser, CO2 and Neodymium lasers; Properties of laser beams: mono-chromaticity, coherence, directionality and brightness, laser speckles, applications of lasers in engineering. Fiber optics and Applications, Types of optical fibers.

**Thermodynamics:** Zeroth law of thermodynamics, first law of thermodynamics, brief discussion on application of 1st law, second law of thermodynamics and concept of Engine, entropy, change in entropy in reversible and irreversible processes, third law of thermodynamics.

**Laboratory**

1) Magnetic field along the axis of current carrying coil – Stewart and Gee
2) Determination of Hall coefficient of semi-conductor
3) Determination of Plank constant
4) Determination of wave length of light by Laser diffraction method
5) Determination of wave length of light by Newton's Ring method
6) Determination of laser and optical fiber parameters
7) Determination of Stefan's Constant.

**Text Books:**

1. Beiser A, "Concepts of Modern Physics", Fifth Edition, McGraw Hill International.
2. David Halliday, Robert Resnick, Jearl Walker, "Fundamentals of Physics", Wileyplus.

**Reference Books:**

3. Ajoy Ghatak, "Optics" Fifth Edition, Tata McGraw Hill.
4. Sears &Zemansky, "University Physics", Addison-Wesley.
5. Jenkins and White, "Fundamentals of Optics", Third Edition, McGraw-Hill.

## Engineering Drawing

## COURSE INFORMATION:

| | |
|---|---|
| **SCHOOL :** Engineering & Technology | **COURSE TYPE:** L-T-P |
| **NAME:** Engineering Drawing | **COURSE CREDIT :** 02 [2-0-0] |
| **DEPARTMENT:** Mechanical Engineering | **CATEGORY:** ES |
| **CODE:** 1102111 | **SEMESTER:** First |
| **PRE-REQUISITE (If Any):** | |

## SYLLABUS OUTLINE:

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**Introduction to Technical Drawing Standard:** Technical Drawing, ISO Standard, Paper Size, Lay out, Line, Scale, Title Block, Application of lines, drawing folding, view, projection, auxiliary view.

**Section and Dimension:** Section and hatch, type of hatch. Coordinate and dimension, Chain dimension, Parallel dimension, Combined dimension, Coordinates dimension, Chord, Arc, Angle, Chamfer, Countersink, Dimension of Cylinder part, cubical part, sheet metal part.

**Tolerance:** Classification of tolerance, Linear tolerance, Angular Tolerance, Special tolerance. • Tolerance indication. Bilateral and Unilateral tolerance, tolerance and fit, geometrical tolerance.

**Parts, Welding and Assembly:** Introduction standard parts, part drawing. Introduction to welding, welding symbols and indication to drawing, assembly drawing.

**Text Books:**
1. "Technical Drawing", Authors: Giesecke, Mitchell, Spencer, Hill, Dygdon, Novak, Publisher: Pearson, Prentice Hall, ISBN:0-13-178446-3
2. "Technical Drawing", Publisher: ISO Standard Handbook, ISBN: 178446 – 3

## Fundamentals of Computer Science & Problem Solving

## COURSE INFORMATION:

| | |
|---|---|
| **SCHOOL :** Engineering & Technology | **COURSE TYPE:** L-T-P |
| **NAME:** Fundamentals of Computer Science & Problem Solving | **COURSE CREDIT :** 03 [3-0-0] |
| **DEPARTMENT:** Computer Sc. & Engg. | **CATEGORY:** ES |
| **CODE:** 1112112 | **SEMESTER:** First |
| **PRE-REQUISITE (If Any):** | |

## SYLLABUS OUTLINE:

**Introduction to Computers**: Computer Systems, Computing Environments, Computer Languages, Creating and Running Programs, Software Development, Flow charts.

**Number Systems**: Binary, Octal, Decimal, and Hexadecimal.

**Problem Solving approach:** Algorithm, structure of algorithm, running time, formulate simple algorithm for arithmetic and logical problems.

**Imperative languages**: Introduction to python programming language; syntax and constructs of a specific language.

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**Types Operator and Expressions with discussion of variable naming and Hungarian Notation:** Variable Names, Data Type and Sizes, Constants, Declarations, Arithmetic Operators, Relational Operators, Logical Operators, Type Conversion, Increment Decrement Operators, Bitwise Operators, Assignment Operators and Expressions, Precedence and Order of Evaluation.

**Control Flow with discussion on structured and unstructured programming:** Statements and Blocks, If-Else statement, Loops: while, do-while, for. Concept of break, continue and pass statement.

**Functions and Program Structure with discussion on standard library:** Basics of functions, parameter passing and returning type, Block structure, Initialization, Recursion and return types. Concept of module and packages.

Basic concepts of tuple, list, dictionary and string. Linear and Binary Search, Selection and Bubble Sort.

File handling using python.

**Laboratory:**

1. Algorithm and flowcharts of small problems like GCD
2. Structured code writing with:
    i. Small but tricky codes
    ii. Proper parameter passing
    iii. Command line Arguments
    iv. Variable parameter
    v. Make file utility
    vi. Multi module program

**Text Books:**
1. Harsh Bhasin, “Python for Beginners”, Second Edition.
2. Mark Lutz, “Learning Python”, FifthEdition, O Reilly.

**Reference Books:**
3. Brown Martin C, “Python: The Complete Reference”, McGraw Hill.
4. David M. Beazley, “Python Essential reference”, third edition, Sams publishing.

## Principles of Electrical Engineering

## COURSE INFORMATION:

| | |
|---|---|
| **SCHOOL :** Engineering & Technology | **COURSE TYPE:** L-T-P |

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| | |
|---|---|
| **NAME:** Principles of Electrical Engineering | **COURSE CREDIT :** 03 [3-0-0] |
| **DEPARTMENT:** Electrical Engineering | **CATEGORY:** ES |
| **CODE:** 1132113 | **SEMESTER:** First |
| **PRE-REQUISITE (If Any):** | |

## SYLLABUS OUTLINE:

**Introduction and overviews**: Electron Devices, Circuits and Systems, Integrated Circuits, Analog and digital signals

**Basic Concepts and Circuit Analysis**: Concept of Potential difference, voltage, current, Fundamental linear passive and active elements to their functional current-voltage relation, Terminology and symbols in order to describe electric networks, Concept of work, power, energy and conversion of energy. DC Circuits-Current-voltage relations of electric network by mathematical equations to analysis the network (Thevenin's theorem, Norton's Theorem, Maximum Power Transfer theorem) voltage source and current sources, ideal and practical, Kirchhoff's laws and applications to network solutions using mesh analysis, Simplifications of networks using series- parallel, Star/Delta transformation. Superposition theorem. AC Circuits-AC waveform definitions, form factor, peak factor, study of R-L, R-C, RLC series circuit, R-L-C parallel circuit, phasor representation in polar and rectangular form, concept of impedance, admittance, active, reactive, apparent and complex power, power factor, 3 phase Balanced AC Circuits.

**Principle of Electro-mechanics and Electrostatics**: Electrostatic field, electric field intensity, electric field strength, absolute permittivity, relative permittivity, capacitor composite, dielectric capacitors, capacitors in series& parallel, energy stored in capacitors, charging and discharging of
capacitors, Principle of batteries, types, construction and application.

**Electro-mechanics:** Electricity and Magnetism, magnetic field and faraday's law, self and mutual inductance, Ampere's law, Magnetic circuit, Magnetic material and B-H Curve, Single phase transformer, principle of operation, EMF equation, voltage ratio, current ratio, KVA rating, efficiency and regulation, Electromechanical energy conversion, Basic concept of indicating and integrating instruments.

**Measurements and Sensors**: Introduction to measuring devices/sensors and transducers related to electrical signals, Elementary methods for the measurement of electrical quantities in DC and AC systems and their practical application.

**Electrical Wiring and Illumination system:** Basic layout of distribution system, Types of Wiring System &Wiring Accessories, Necessity of earthing, Types of earthing, Different types of lamps (Incandescent, Fluorescent, Sodium Vapour, Mercury Vapour, Metal Halide, CFL, LED)

**Laboratory**

1. Familiarization of electrical Elements, sources, measuring devices and transducers related to electrical circuits

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2. Determination of resistance temperature coefficient
3. Verification of Network Theorem (Superposition, Thevenin, Norton, Maximum Power Transfer theorem)
4. Simulation of R-L-C series circuits for XL> XC , XL< XC & XL= XC
5. Simulation of Time response of RC circuit
6. Verification of relation in between voltage and current in three phase balanced star and delta connected loads.
7. Demonstration of measurement of electrical quantities in DC and AC systems.

**Text Books:**

1. A. E. Fitzgerald, Kingsely Jr Charles, D. Umans Stephen, "Electric Machinery", Sixth Edition Tata McGraw Hill.
2. B. L.Theraja, "A Textbook of Electrical Technology", vol. I, S. Chand and Company Ltd., New Delhi.
3. V. K. Mehta, "Basic Electrical Engineering", S. Chand and Company Ltd., New Delhi.
4. J. Nagrath and Kothari, "Theory and problems of Basic Electrical Engineering", Second Edition Prentice Hall of India Pvt. Ltd.

**Reference Books:**

5. Edward Hughes, "Electrical Technology", Tenth Edition, Pearson Education Publication.
6. Vincent. Del. Toro, "Electrical Engineering Fundamentals", Second Edition, Prentice Hall India.
7. Sudhakar Shyammohan, "Circuits and Networks: Analysis and Synthesis", Fifth Edition Tata McGraw Hill Education.

## Communicative English – I

## COURSE INFORMATION:

| | |
|---|---|
| **SCHOOL :** Engineering & Technology | **COURSE TYPE:** L-T-P |
| **NAME:** Communicative English - I | **COURSE CREDIT :** 02 [2-0-0] |
| **DEPARTMENT:** English | **CATEGORY:** HSM |
| **CODE:** 1216111 | **SEMESTER:** First |
| **PRE-REQUISITE (If Any):** | |

## SYLLABUS OUTLINE:

**Grammar:**
Noun and Pronoun (Types and Functions), Verbs (Lexical and Auxiliary), Verb Tenses, Adjectives and Adverb, Article and Preposition, Conjunction, Phrases, Clause (Noun, Adjective, Adverb), Sentence Types (Simple, Compound and Complex), Transformations (Active-Passive, Direct-Indirect)

**Vocabulary:**

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One-word Substitution, Homophones, Proverbs, Synonyms and Antonyms

**Phonetics:**
Air-stream Mechanism, Vowel and Consonant Sounds, Intonation

**Communication Theory:**
Definition of Communication, Types of Communication (Verbal & Non-Verbal; Formal & Informal; Intra-personal, Inter-personal, Extra-personal, Group, Mass), Flows of Communication (Vertical, Horizontal and Diagonal), Barriers of Communication

**Comprehension:**
Reading and Comprehension, Objective and Subjective Questions.

**Text Books:**
1. Intermediate English Grammar- Cambridge University Press
2. High School English Grammar- Wren and Martin

**Reference Books:**
3. English vocabulary in use – Alan Mc'carthy and O'dell
4. APAART: Speak Well 1 (English language and communication)
5. APAART: Speak Well 2 (Soft Skills)

## Environmental Science

## COURSE INFORMATION:

| | |
|---|---|
| **SCHOOL :** Engineering & Technology | **COURSE TYPE:** L-T-P |
| **NAME:** Environmental Science | **COURSE CREDIT :** 02 [2-0-0] |
| **DEPARTMENT:** Chemistry | **CATEGORY:** MUS |
| **CODE:** 1158111 | **SEMESTER:** First |
| **PRE-REQUISITE (If Any):** | |

## SYLLABUS OUTLINE:

**Introduction:** Definition, principles and scope of Environmental Science, Earth, Man and Environment. Ecosystems, Pathways in Ecosystems. Physico-chemical and Biological factors in the Environment, Structure and composition of atmosphere, hydrosphere, lithosphere and biosphere. Mass and Energy transfer across the various interfaces, material balance. Atmospheric stability, Natural resources, conservation and sustainable development.

**Fundamentals of Environmental Chemistry:** Stochiometry, Gibbs' energy, Chemical potential, Chemical equilibria, acid base reactions, solubility product, solubility of gases in water, the carbonate system, unsaturated and saturated hydrocarbons, radionuclides.

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**Chemical composition of Air:** Classification of elements, chemical speciation. Particles, ions and radicals in the atmosphere. Chemical processes for formation of inorganic and organic particulate matter. Thermochemical and photochemical reactions in the atmosphere. Oxygen and ozone chemistry. Chemistry of air pollutants, Photochemical smog.

**Ecosystem:** Structure and functions, Abiotic and Biotic components, energy flows, Food Chains, Food web, Ecological pyramids, types and diversity. Ecological Succession, Population, Community ecology and Parasitism, Preypredator relationships.

**Mineral Resources and Environment:** Resources and Reserves, Minerals and Population. Oceans as new areas for exploration of mineral resources. Ocean ore and recycling of resources. Environmental impact of exploitation, processing and smelting of minerals.

**Water Resources and Environment:** Global Water Balance. Ice Sheets and fluctuations of sea levels. Origin and composition of seawater. Hydrological cycle. Factors influencing the surface water. Types of water. Resources of oceans. Ocean pollution by toxic wastes. Human use of surface and groundwater. Groundwater pollution.

**Text Book:**
1. Environmental Science, Miller T.G. Jr., Wadsworth Publishing Co.
2. Environmental Biology, Agarwal, K.C. 2001, Nidi Publ. Ltd.

**Reference Books:**
3. The Biodiversity of India, Bharucha Erach, Mapin Publishing Pvt. Ltd.
4. Environmental Chemistry, De A.K, Wiley Eastern Ltd.
5. Environmental Science systems & Solutions, Mckinney, M.L. & School, R.M. 1996

## Engineering Mathematics - II

## COURSE INFORMATION:

| | |
|---|---|
| **SCHOOL :** Engineering & Technology | **COURSE TYPE:** L-T-P |
| **NAME:** Engineering Mathematics – II | **COURSE CREDIT :** 03 [3-0-0] |
| **DEPARTMENT:** Mathematics | **CATEGORY:** BS |
| **CODE:** 1191121 | **SEMESTER:** Second |
| **PRE-REQUISITE (If Any): Mathematics-I** | |

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## SYLLABUS OUTLINE:

**Algebraic Structures:** Sets, algebra of sets and their applications, Relations, Mapping, Groups, Abelian groups, Subgroups, Cyclic groups, Permutation group, Definition of Ring, Field and simple related problems.

**Graph Theory:** Graphs, Digraphs, Weighted graph, Connected and disconnected graphs, Complement of a graph, Regular graph, Complete graph, Sub graph, Walks, Paths, Circuits, Euler Graph, Cut sets and cut vertices, Matrix representation of a graph, Adjacency and incidence matrices of a graph, Graph isomorphism, Bipartite graph. Eulers formula (n - e + r = 2) for connected planar graph and its generalisation for graphs with connected components. Detection of planarity. Graph colouring. Chromatic numbers of Cn, Kn, Km,n and other simple graphs. Simple applications of chromatic numbers.

**Tree:** Definition and properties, Binary tree, Spanning tree of a graph, Minimum spanning tree, properties of trees, Algorithms: Dijkstra's Algorithm for shortest path problem, Determination of minimal spanning tree using Kruskal's and Prim's algorithms.

**Propositional Calculus:** Proposition, propositional variables, combination of propositions ,Conjunction, Disjunction, Negation and their truth table, derived connectors. Conditional Connectives, Implication, Converse, Contrapositive, Inverse, Bi conditional statements with truth table, Logical Equivalence, Tautology, Normal forms-CNF, DNF; Predicates and Logical Quantifications of propositions and related examples.
Counting Techniques: Permutations, Combinations, Binomial coefficients, Pigeon-hole Principle, Principles of inclusion and exclusions; Generating functions, Recurrence Relations and their solutions using generating function, Recurrence relation of Fibonacci numbers and it's solution, Divide-and-Conquer algorithm and its recurrence relation and its simple application in computer.

**Boolean Algebra and Combinatorial Circuits:** Definition, Sub-Algebra, Isomorphic Boolean Algebra, Boolean functions and expressions, DNF and CNF, principle of duality, design of digital circuits, Applications of Boolean algebra in switching theory, series and parallel connections, Karnaugh Maps, minimization of Boolean expression using k-map.

**Text Books:**

1. Higher Algebra, S. K. Mapa, Levant Books.
2. N. Deo, Graph Theory with applications to Engineering and Computer Science Prentice Hall Of India, 2007, ISBN: 978-81-203-0145-0
3. S. Pal and S.C. Bhunia, Engineering Mathematics, Oxford University Press, 2015, ISBN 978-0-19-807089-4
4.S. K. Sarkar, A text book of Discrete Mathematics, S. Chand & Company Ltd., 2006. ISBN : 81-219-2232-1

**Reference Books:**

5. S. B. Gupta, Discrete Mathematics and Structures , Laxmi Publications(P) Ltd., 2007 ISBN: 81-7008-918-2
6. D. S. Malik and M.K. Sen, Discrete Mathematics Theory and Applications (Revised Addition), Cengage Learning, 2017, ISBN: 978-81-315-1866-3
7. Advanced Engineering Mathematics - Erwin Kreyszig is published by Wiley India
8. D. Poole, Linear Algebra –A Modern Introduction, CENGAGE Learning, 2015 ISBN: 978-81-315-30245

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# Engineering Chemistry

## COURSE INFORMATION:

| | |
|---|---|
| **SCHOOL :** Engineering & Technology | **COURSE TYPE:** L-T-P |
| **NAME:** Engineering Chemistry | **COURSE CREDIT :** 03 [3-0-0] |
| **DEPARTMENT:** Chemistry | **CATEGORY:** BS |
| **CODE:** 1161122 | **SEMESTER:** Second |
| **PRE-REQUISITE (If Any):** | |

## SYLLABUS OUTLINE:

**Thermodynamics of Chemical Processes:** Concept of entropy, Chemical potential, Equilibrium conditions for closed systems, Phase and reaction equilibria, Maxwell relations, Real gas and real solution.

**Electrochemical Systems:** Electrochemical cells and EMF, Applications of EMF measurements: Thermodynamic data, activity coefficients, solubility product and pH, corrosion.

**Kinetics of Chemical Reactions:** Reversible, consecutive and parallel reactions, Steady state approximation, Chain reactions, Photochemical kinetics.

**Bonding Models in Inorganic Chemistry:** Molecular orbital theory, Valence-bond theory, Crystal field theory.

**Fundamentals of Microwave, IR and UV-VIS Spectroscopy:** Basic concepts of spectroscopy, Selection rule, Determination of molecular structure.

**Coordination Chemistry:** Coordination numbers, Chelate effect, Coordination complexes and application, Bio-inorganic chemistry: Metal ions in Biological systems, environmental aspects of Metals, NOx, CO, CO2.

**Organic Reaction Mechanism:** Mechanisms of selected organic, bio-organic, polymerization and catalytic reactions. Stereochemistry of Carbon Compounds: Selected Organic Compounds: Natural products and Biomolecules (Amino acids/nucleic acids/proteins).

**Laboratory Component:** Surface tension and parachor, Measurement of the coefficient of viscosity: CMC of a surfactant, Conductometric titration, pH-metric/potentiometric titration, Solubility product, Kinetics of ester hydrolysis, Estimation of Fe2+, EDTA titration, Estimation of base content and acid content of commercially available antacid and vitamin C respectively, Synthesis of Mohr's salt, Synthesis of aspirin, Demonstration of a few important physico-chemical processes. (e.g. Gel electrophoresis, Oscillatory reactions)

**Text Books:**
1. Engineering Chemistry, Satyaprakash, Khanna Book Publishing, Delhi
2. Chemistry: Principles and Applications, by M. J. Sienko and R. A. Plane

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3. Fundamentals of Molecular Spectroscopy, by C. N. Banwell

**Reference Books:**
4. Engineering Chemistry (NPTEL Web-book), by B. L. Tembe, M. S. Krishnan
5. Physical Chemistry, P. C. Rakshit, Sarat Book House

## Introduction to Manufacturing Processes

## COURSE INFORMATION:

| | |
|---|---|
| **SCHOOL :** Engineering & Technology | **COURSE TYPE:** L-T-P |
| **NAME:** Workshop / Manufacturing Practices | **COURSE CREDIT :** 02 [2-0-0] |
| **DEPARTMENT:** Physics | **CATEGORY:** ES |
| **CODE:** 1102121 | **SEMESTER:** Second |
| **PRE-REQUISITE (If Any):** | |

## SYLLABUS OUTLINE:

**Theory Component:** Basic concepts and principles of manufacturing, Performing Processes: Casting, forging, rolling, drawing, extrusion, press tool work, plastic moulding and powder metallurgy, Joining Processes: Welding, brazing and crimping, Semi-finishing and finishing processes: Machining (Turning, shaping, drilling, Milling and grinding), Non-traditional Processes: Abrasive jet machining, Ultrasonic machining, Electro-discharge machining, Electrochemical machining and laser beam machining, Product Quality: Possible defects and their detection, assessment and remedy.

**Laboratory Component:** Suggested Assignments: Introducing to various machine tools and demonstration on machining, Making a steel pin as per drawing by machining in centre lathe, External screw thread by single point chasing in lathe, Making a cast iron Vee block by shaping, Making a regular polygon prism (MS) by milling, Making a gauge as per drawing, Study of machining in machining in machining centre (CNC) and Electro discharge machining (EDM), Orientation, demonstration and practice on metal casting, Practicing sand moulding using split and uneven parting line pattern, Practice on CO2 moulding and machine moulding, Mechanised sand preparation and melting practice, Practice on Oxy-acetylene gas welding and manual metal arc welding (running bead), Practice on oxy-acetylene gas cutting and arc welding for butt welding, Introduction and demonstration on submerged arc welding and plasma spray coating, Demonstration of deep drawing process.

**Reference Books:**
1. Elements of Workshop Technology, Hajra Choudhury S.K., Hajra Choudhury A.K. and Nirjhar Roy S.K, Media promoters and publishers, Mumbai.
2. Manufacturing Engineering and Technology, Kalpakjian S. and Steven S. PEI India Edition.
3. Manufacturing Technology, G. P. Hariharan and A. Suresh, Pearson Education, 2008.
4. Processes and Materials of Manufacture, Roy A. Lindberg, Prentice Hall India, 1998.
5. Manufacturing Technology, Rao P.N, TMG

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# Principles of Computer Programming

## COURSE INFORMATION:

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|---|---|
| **SCHOOL :** Engineering & Technology | **COURSE TYPE:** L-T-P |
| **NAME:** Principles of Computer Programming | **COURSE CREDIT :** 03 [3-0-0] |
| **DEPARTMENT:** Computer Sc. & Engg. | **CATEGORY:** ES |
| **CODE:** 1112122 | **SEMESTER:** Second |
| **PRE-REQUISITE (If Any): Fundamental of Computer Sc. & Problem solving** | |

## SYLLABUS OUTLINE:

**Imperative languages**: Introduction to imperative language; syntax and constructs of a specific language (ANSI C):

**Types Operator and Expressions with discussion of variable naming and Hungarian Notation:** Variable Names, Data Type and Sizes (Little Endian Big Endian), Constants, Declarations, Arithmetic Operators, Relational Operators, Logical Operators, Type Conversion, Increment Decrement Operators, Bitwise Operators, Assignment Operators and Expressions, Precedence and Order of Evaluation, proper variable naming and Hungarian Notation

**Control Flow with discussion on structured and unstructured programming:** Statements and Blocks, If-Else-If, Switch, Loops – while, do, for, break and continue, Goto Labels, structured and un-structured programming

**Functions and Program Structure with discussion on standard library:** Basics of functions, parameter passing and returning type, C main return as integer, External, Auto, Local, Static, Register Variables, Scope Rules, Block structure, Initialization, Recursion, Preprocessor, Standard Library Functions and return types.

**Pointers and Arrays:** Concepts, Using Arrays in C, Inter-Function Communication, Array Applications, Two-Dimensional Arrays, Multidimensional Arrays, Pointers and address, Pointers and Function Arguments, Pointers and Arrays, Address, Pointers to Pointers, Compatibility, Lvalue and Rvalue, Arrays and Pointers, Pointer Arithmetic and Arrays, Passing an Array to a Function, Memory Allocation Functions, Array of Pointers, Programming Applications, Pointers to void, Pointers to Functions, Arithmetic, character Pointers and functions, Pointer Arrays, Pointer to Pointer, Multi-dimensional array and Row/column major formats, Initialization of Pointer Arrays, Command line arguments, Pointer to functions, complicated declarations and how they are evaluated.

**Input and Output:** Standard I/O, Formatted Output – printf, Formated Input – scanf, Variable length argument list, file access including FILE structure, fopen, stdin, sdtout and stderr, Error Handling including exit, perror and error.h, Line I/O, related miscellaneous functions

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**Storage Class:** Different type of Storage Classes, automatic, register, static and external. Local variable and global variable, scope and rules. Static and automatic storage in global variable. Accessing through several functions. Simple program using recursions.

**Structures and Unions:** Basic Structures, Structures and Functions, Array of structures, Pointer of structures, Self-referral Structures, Table look up, Typedef, Unions, Bit-fields.

**Dynamic Memory allocation:** Memory allocation functions such as malloc(), calloc(), free(), realloc(). Define linked list in terms of dynamic memory allocation, different operations such as insert, delete, and traversal. Implementation of circular linked list.

**File handling:** File Descriptor, Low level I/O – read and write, Open, create, close and unlink, Random access – seek, Discussions on Listing Directory, Storage allocator.

**Laboratory:**

1. Algorithm for complex problem
2. Structured code writing with:
    i. Array on different dimension
    ii. Pointer handling
    iii. Pointer vs array
    iv. Pointer to functions
    v. Define structure
    vi. User defined header
    vii. Make file utility
    viii. Multi file program and user defined libraries
    ix. Linked list
    x. Recursion

**Text Books:**

1. B. W. Kernighan and D. M. Ritchi, “The C Programming Language”, Second Edition, PHI.
2. B. Gottfried, “Programming in C”, Second Edition, Schaum Outline Series.

**Reference Books:**

3. Herbert Schildt, “C: The Complete Reference”, Fourth Edition, McGraw Hill.
4. Reema Theraja, “Programming in C”, Oxford University press.

## Analog and Digital Electronics

## COURSE INFORMATION:

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|---|---|
| **SCHOOL :** Engineering & Technology | **COURSE TYPE:** L-T-P |

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|---|---|
| **NAME:** Principles of Electronics Engineering | **COURSE CREDIT :** 03 [3-0-0] |
| **DEPARTMENT:** Electronics & Communication Engg. | **CATEGORY:** ES |
| **CODE:** 1122123 | **SEMESTER:** Second |
| **PRE-REQUISITE (If Any):** | |

## SYLLABUS OUTLINE:

**Unit 1:** **[8L]**

**Photodiodes, Light Emitting Diodes and Optocouplers, BJT Biasing:**
Fixed bias ,Collector to base Bias , voltage divider bias, Operational Amplifier Application Circuits: Multivibrators using IC-555, Peak Detector, Schmitt trigger, Active Filters, Non-Linear Amplifier, Relaxation Oscillator, Current-to-Voltage and Voltage-to-Current Converter , Regulated Power Supply Parameters, adjustable voltage regulator, D to A and A to D converter.

**Unit 2:** **[6L]**

**Karnaugh Maps:**
Basic gates and Boolean algebra, minimum forms of switching functions, two and three variable Karnaugh maps, four variable karnaugh maps, determination of minimum expressions using essential prime implicants, Quine-McClusky Method: determination of prime implicants, The prime implicant chart, petricks method, simplification of incompletely specified functions, simplification using map-entered variables.

**Unit 3:** **[7L]**

**Combinational circuit design and simulation using gates:**
Review of Combinational circuit design, design of circuits with limited Gate Fan-in ,Gate delays and Timing diagrams, Hazards in combinational Logic, simulation and testing of logic circuits
**Multiplexers, Decoders and Programmable Logic Devices:**
Multiplexers, three state buffers, decoders and encoders, Programmable Logic devices, Programmable Logic Arrays, Programmable Array Logic.

**Unit 4:** **[7L]**

**Introduction to VHDL:**
VHDL description of combinational circuits, VHDL Models for multiplexers, VHDL Modules.
**Latches and Flip-Flops:**
Set Reset Latch, Gated Latches, Edge-Triggered D Flip Flop 3,SR Flip Flop, J K Flip Flop, T Flip Flop, Flip Flop with additional inputs, Asynchronous Sequential Circuits.

**Unit 5:** **[8L]**

**Registers and Counters:**
Registers and Register Transfers, Parallel Adder with accumulator, shift registers, design of Binary counters, counters for other sequences, counter design using SR and J K Flip Flops, sequential parity checker, state tables and graphs.

**Text Book:**
1. Charles H Roth and Larry L Kinney, Analog and Digital Electronics, Cengage Learning,2019.

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**References Books:**
2. Anil K Maini, Varsha Agarwal, Electronic Devices and Circuits, Wiley, 2012.
3. Donald P Leach, Albert Paul Malvino & Goutam Saha, Digital Principles and Applications, 8th Edition, Tata McGraw Hill, 2015.
4. M. Morris Mani, Digital Design, 4th Edition, Pearson Prentice Hall, 2008.
5. David A. Bell, Electronic Devices and Circuits, 5th Edition, Oxford University Press, 2008.

## Biology for Engineers

## COURSE INFORMATION:

| | |
|---|---|
| **SCHOOL :** Engineering & Technology | **COURSE TYPE:** L-T-P |
| **NAME:** Biology for Engineers | **COURSE CREDIT :** 02 [2-0-0] |
| **DEPARTMENT:** Biological Science | **CATEGORY:** BS |
| **CODE:** 1151123 | **SEMESTER:** Second |
| **PRE-REQUISITE (If Any):** | |

## SYLLABUS OUTLINE:

**Introduction:** The underlying criterion, such as morphological, biochemical or ecological be highlighted. Hierarchy of life forms at phenomenological level. Classification: (a) cellularity- Unicellular or multicellular (b) ultrastructure- prokaryotes or eucaryotes. (c) energy and Carbon utilization -Autotrophs, heterotrophs, lithotropes (d) Ammonia excretion – aminotelic, uricoteliec, ureotelic (e) Habitata- acquatic or terrestrial (e) Molecular taxonomy- three major kingdoms of life. A given organism can come under different category based on classification.

**Genetics Purpose:** Concept of allele. Gene mapping, Gene interaction, Epistasis. Meiosis and Mitosis be taught as a part of genetics. Emphasis to be give not to the mechanics of cell. Concepts of recessiveness and dominance. Concept of mapping of phenotype to genes. Discuss about the single gene disorders in human and human genetics genetics.

**Biomolecules Purpose:** Amino acids and proteins. Nucleotides and DNA/RNA. Two carbon units and lipids. AICTE Model Curriculum for Undergraduate degree in Civil Engineering (Engineering & Technology).
**Enzymes Purpose:** Enzyme classification. Mechanism of enzyme action. Discuss at least two examples. Enzyme kinetics and kinetic parameters. Why should we know these parameters to understand biology? RNA catalysis.

**Information Transfer Purpose:** The molecular basis of coding and decoding genetic information is universal Molecular basis of information transfer. DNA as a genetic material. Hierarchy of DNA structure- from single stranded to double helix to nucleosomes. Concept of genetic code. Universality and degeneracy of genetic code. Define gene in terms of complementation and recombination.

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**Macromolecular analysis Purpose:** How to analyses biological processes at the reductionistic level Proteins-structure and function. Hierarch in protein structure. Primary secondary, tertiary and quaternary structure. Proteins as enzymes, transporters, receptors and structural elements.
**Metabolism Purpose:** The fundamental principles of energy transactions are the same in physical and biological world. Thermodynamics as applied to biological systems. Exothermic and endothermic versus endergonic and exergoinc reactions.

**Microbiology Concept:** Identification and classification of microorganisms. Microscopy. Ecological aspects of single celled organisms.

**Text Books:**
1. Biology: A global approach: Campbell, N. A.; Reece, J. B.; Urry, Lisa; Cain, M, L.; Wasserman, S. A.; Minorsky, P. V.; Jackson, R. B. Pearson Education Ltd
2. Outlines of Biochemistry, Conn, E.E; Stumpf, P.K; Bruening, G; Doi, R.H., John Wiley and Sons.
3. Principles of Biochemistry (V Edition), By Nelson, D. L.; and Cox, M. M.W.H. Freeman and Company.

**Reference Books:**
4. Molecular Genetics (Second edition), Stent, G. S.; and Calender, R.W.H. Freeman and company, Distributed by Satish Kumar Jain for CBS Publisher
5. Microbiology, Prescott, L.M J.P. Harley and C.A. Klein 1995. 2nd edition Wm, C. Brown Publishers.

## Communicative English – II

## COURSE INFORMATION:

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|---|---|
| **SCHOOL :** Engineering & Technology | **COURSE TYPE:** L-T-P |
| **NAME:** Communicative English - II | **COURSE CREDIT :** 02 [2-0-0] |
| **DEPARTMENT:** English | **CATEGORY:** HSM |
| **CODE:** 1216121 | **SEMESTER:** Second |
| **PRE-REQUISITE (If Any):** | |

## SYLLABUS OUTLINE:

**Grammar:**
Verbs- Gerund, Participle, Infinitives, Modal Verbs; Adjectives- Degree of Comparison, Transformation (Positive, Comparative, Superlative); Moods - Declarative, Imperative, Exclamatory, Interrogative, Subjunctive, Optative, Conditional; Prepositions- Simple, Compound, Phrase

**Vocabulary:**
One-word Substitution, Homophones, Figures of Speech (simile, metaphor), Business Idioms

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**Communication Theory:**
Audience Analysis, 7 Cs of Communication, SWOT Analysis

**Comprehension:**
1. Reading and Comprehension, Objective and Subjective Questions
2. Understanding Visual Data- Graphs, Charts, Tables

**Writing:**
Business Letters- Application, Complaints, Order, Collection, Sales Promotional Letter; Notice, Memorandum, Agenda, Minutes, Advertisements.

**Text Books**
1. High School English Grammar by Wren and Martin
2. Developing Communication Skills by Krishna Mohan and Meera Banerji

**Reference Books:**
3. Technical Communication- Meenakshi Raman and Sangeeta Sharma
4. Professional Communication by Ashraf Rizvi

## Engineering Mathematics- III

## COURSE INFORMATION:

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|---|---|
| **SCHOOL :** Engineering & Technology | **COURSE TYPE:** L-T-P |
| **NAME:** Engineering Mathematics-III | **COURSE CREDIT :** 03 [3-0-0] |
| **DEPARTMENT:** Computer Sc & Engg. | **CATEGORY:** BS |
| **CODE:** 1191131 | **SEMESTER:** Third |
| **PRE-REQUISITE (If Any): Mathematics-II** | |

## SYLLABUS OUTLINE:

**Linear Algebra:** Determinant and its properties (up to third order), Minor and cofactors, Matrices, addition, multiplication and transpose of a matrix, Symmetric and skew-symmetric matrices and their properties, Adjoint, Inverse matrix, Rank of matrix, Solution of linear system by using Gaussian elimination, LU decomposition method. Vector space, Dimension, orthogonality, projections, Gram-Schmidt orthogonalization.
Eigenvalue and Eigen vectors; positive definite matrices. Linear transformations, Hermitian and unitary matrices.

**Vector Calculus:** Physical significances of grad, div, curl. Line integral, surface integral, volume integral- physical examples in the context of electricity and magnetism and statements of Stokes theorem and Gauss

theorem [No Proof]. Expression of grad, div, curl and Laplacian in Spherical and Cylindrical co-ordinates.

**Complex Analysis:** Differentiation of complex functions, Cauchy Riemann equations, Analytic functions, Harmonic functions, determination of harmonic conjugate, elementary analytic functions (exponential, trigonometric, logarithmic) and their properties; Conformal mappings, Mobius transformations and their properties. Contour integrals, Cauchy Goursat theorem (without proof), Cauchy integral formula (without proof), Liouville's theorem and Maximum Modulus theorem (without proof); Taylor's series, Zeros of analytic functions, Singularities, Laurent's series; Residues, Cauchy residue theorem (without proof), Evaluation of definite integral involving sine and cosine, Evaluation of certain improper integrals using the Bromwich contour.

**Text Books:**

1. Advanced Higher Algebra, Chakravorty and Ghosh, U N Dhar Pvt. Ltd.ISBN 9789380673677
2. Higher Algebra, S. K. Mapa, Levant Books.
3. Integral Calculus including Differential Equations, Das and Mukherjee, U N Dhar Pvt. Ltd.ISBN: 978-9380673882
4. Differential Calculus, Das and Mukherjee, U N Dhar Pvt. Ltd. ISBN:9789380673448,
5. Advanced Engineering Mathematics, E Kreyszig, Wiley
6. S. Ponnusamy, Foundation of Complex Analysis, Narosa Publishing House, ISBN: 9788173196294

**Reference Books:**

7. Ghosh and Maity, An Introduction to Analysis: Differential Calculus, New Central Book Agency, 2011, ISBN: 9788173812026
8. G.F. Simmons, Differential Equations with applications and Historical Notes, CRC Press ISBN: 978-1-4987-0259-1
9. M.D. Raisinghania, Ordinary and Partial Differential Equation, S.Chand and Company, 2006 ISBN 81-219-0892-2
10. Advanced Engineering Mathematics 8e by Erwin Kreyszig is published by Wiley India
11. D. Poole, Linear Algebra – A Modern Introduction, CENGAGE Learning, 2015 ISBN: 978-81-315-30245

## Data Structure & Algorithm

## COURSE INFORMATION:

| | |
|---|---|
| **SCHOOL :** Engineering & Technology | **COURSE TYPE:** L-T-P |
| **NAME:** Data Structure & Algorithm | **COURSE CREDIT :** 04 [3-1-0] |
| **DEPARTMENT:** Computer Sc. & Engg. | **CATEGORY:** PC |
| **CODE:** 1113131 | **SEMESTER:** Third |
| **PRE-REQUISITE (If Any):** | |

## SYLLABUS OUTLINE:

**Basic Terminologies & Introduction to Algorithm and Data Organization: [6L]**

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Algorithm specification, Recursion, Performance analysis, Asymptotic Notation - The Big-O, Omega and Theta notation, Programming Style, Refinement of Coding - Time-Space Trade Off, Testing, Data Abstraction.

**Linear Data Structure:** **[12L]**
Array, Stack, Queue, Linked-list and its types, Various Representations, Operations & Applications of Linear Data Structures.

**Non-linear Data Structure:** **[12L]**
Trees (Binary Tree, Threaded Binary Tree, Binary Search Tree, B & B+ Tree, AVL Tree, Splay Tree) and Graphs (Directed, Undirected), Various Representations, Operations (search and traversal algorithms and complexity analysis) & Applications of Non-Linear Data Structures.

**Searching and Sorting on Various Data Structures:** **[10L]**
Sequential Search, Binary Search, Breadth First Search, Depth First Search, Insertion Sort, Selection Sort, Shell Sort, Divide and Conquer Sort, Merge Sort, Quick Sort, Heap Sort, Introduction to Hashing.

**Laboratory**
1. Towers of Hanoi using user defined stacks.
2. Reading, writing, and addition of polynomials.
3. Line editors with line count, word count showing on the screen.
4. Trees with all operations.
5. All graph algorithms.
6. Saving / retrieving non-linear data structure in/from a file

**Text Books:**
1. Fundamentals of Data Structures, E. Horowitz and S. Sahni, 1977.
2. Data Structures and Algorithms, Alfred V. Aho, John E. Hopperoft, Jeffrey D. UIlman.

**Reference Books:**
1. The Art of Computer Programming: Volume 1: Fundamental Algorithms, Donald E. Knuth
2. Introduction to Algorithms, Thomas, H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein.
3. Open Data Structures: An Introduction (Open Paths to Enriched Learning), 31st ed. Edition,
Pat Morin

## Object-Oriented Programming

## COURSE INFORMATION:

| | |
|---|---|
| **SCHOOL :** Engineering & Technology | **COURSE TYPE:** L-T-P |
| **NAME:** Object Oriented Programming | **COURSE CREDIT :** 03 [3-0-0] |
| **DEPARTMENT:** Computer Sc & Engg. | **CATEGORY:** PC |

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|---|---|
| **CODE:** 1113132 | **SEMESTER:** Third |
| **PRE-REQUISITE (If Any):** | |

## SYLLABUS OUTLINE:

**Module 1:** **[8L]**
**Object oriented design:** Concepts of object oriented programming language, Major and minor elements, Object, Class, relationships among objects, aggregation, links, relationships among classes-association, aggregation, using, instantiation, meta-class, grouping constructs.

**Module 2:** **[4L]**
**Object oriented concepts:** Difference between OOP and other conventional programming – advantages and disadvantages. Class, object, message passing, inheritance, encapsulation, polymorphism

**Module 3:** **[6L]**
**Class & Object proprieties :** Basic concepts of java programming – advantages of java, byte-code & JVM, data types, access specifiers, operators, control statements & loops, array, creation of class, object, constructor, finalize and garbage collection, use of method overloading, this keyword, use of objects as parameter & methods returning objects, call by value & call by reference, static variables & methods, garbage collection, nested & inner classes, basic string handling concepts- String (discuss charAt() , compareTo(), equals(), equalsIgnoreCase(), indexOf(), length() , substring(), toCharArray() , toLowerCase(), toString(), toUpperCase() , trim() , valueOf() methods) & StringBuffer classes (discuss append(), capacity(), charAt(), delete(), deleteCharAt(), ensureCapacity(), getChars(), indexOf(), insert(), length(), setCharAt(), setLength(), substring(), toString() methods), concept of mutable and immutable string, command line arguments, basics of I/O operations – keyboard input using BufferedReader & Scanner classes.

**Module 4:** **[6L]**
**Reusability properties:** Super class & subclasses including multilevel hierarchy, process of constructor calling in inheritance, use of super and final keywords with super() method, dynamic method dispatch, use of abstract classes & methods, interfaces. Creation of packages, importing packages, member access for packages.

**Module 5:** **[6L]**
**Exception handling & Multithreading:** Exception handling basics, different types of exception classes, use of try & catch with throw, throws & finally, creation of user defined exception classes. Basics of multithreading, main thread, thread life cycle, creation of multiple threads, thread priorities, thread synchronization, inter-thread communication, deadlocks for threads, suspending & resuming threads.

**Module 6:** **[4L]**
**Applet Programming (using swing) :** Basics of applet programming, applet life cycle, difference between application & applet programming, parameter passing in applets, concept of delegation event model and listener, I/O in applets, use of repaint(), getDocumentBase(), getCodeBase() methods, layout manager (basic concept), creation of buttons (JButton class only) & text field**.**

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**Text Books:**
1. Rambaugh, James Michael, Blaha – "Object Oriented Modelling and Design" – Prentice Hall, India.
2. Ali Bahrami – "Object Oriented System Development" – Mc Graw Hill.
3.Patrick Naughton, Herbert Schildt – "The complete reference-Java2" – TMH.

**References Books:**
4. Deitel and Deitel – "Java How to Program" – 6th Ed. – Pearson.
5. E. Balagurusamy – " Programming With Java: A Primer" – 3rd Ed. – TMH.

## Computer Organization and Architecture

## COURSE INFORMATION:

| | |
|---|---|
| **SCHOOL :** Engineering & Technology | **COURSE TYPE:** L-T-P |
| **NAME:** Computer Organization and Architecture | **COURSE CREDIT :** 04 [3-0-3] |
| **DEPARTMENT:** Computer Sc & Engg. | **CATEGORY:** PC |
| **CODE:** 1113133 | **SEMESTER:** Third |
| **PRE-REQUISITE (If Any): Digital Electronics** | |

## SYLLABUS OUTLINE:

**Basic functional blocks of a computer:** **[4L]**
CPU, memory, input-output subsystems, control unit. Instruction set architecture of a CPU - registers, instruction execution cycle, RTL interpretation of instructions, addressing modes, instruction set. Case study - instruction sets of some common CPUs.

**Data representation:** **[8L]**
Signed number representation, fixed and floating point representations, character representation. Computer arithmetic - integer addition and subtraction, ripple carry adder, carry look-ahead adder, etc. multiplication - shift-and-add, Booth multiplier, carry save multiplier, etc. Division - restoring and non-restoring techniques, floating point arithmetic.

**CPU control unit design:** **[4L]**
Hardwired and micro-programmed design approaches, Case study - design of a simple hypothetical CPU. Memory system design, semiconductor memory technologies, memory organization.

**Peripheral devices and their characteristics:** **[8L]**
Input-output subsystems, I/O transfers - program controlled, interrupt driven and DMA, privileged and non-privileged instructions, software interrupts and exceptions. Programs and processes - role of interrupts in process state transitions.

**Pipelining:** **[4L]**

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Basic concepts of pipelining, throughput and speedup, pipeline hazards.

**Memory organization:** **[6L]**
Memory interleaving, concept of hierarchical memory organization, cache memory, cache size vs. block size, mapping functions, replacement algorithms, write policies.

**Laboratory Component:** [**6L**]
Familiarization with assembly language programming, Synthesis / design of simple data paths and controllers, processor design, interfacing with CPU, DAC, ADC, keyboard-display modules, etc, Development kits as well as Microprocessors/PCs may be used for the laboratory, along with design/ simulation tools as and when necessary.

**Text Books:**
1. Computer Organization and Design: The Hardware/Software Interface, David A. Patterson and John L. Hennessy, Elsevier.
2. Computer Organization, Carl Hamachar, Zvonco Vranesic and Safwat Zaky, McGraw Hill.
3. Computer Architecture and Organization, John P. Hayes, McGraw Hill.

**Reference Books:**
4. Computer Organization and Architecture: Designing for Performance, William Stallings, Pearson Education.
5. Computer Systems Design and Architecture, Vincent P. Heuring and Harry F. Jordan, Pearson Education.

## Formal Language and Automata Theory

## COURSE INFORMATION:

| | |
|---|---|
| **SCHOOL :** Engineering & Technology | **COURSE TYPE:** L-T-P |
| **NAME:** Formal Language and Automata Theory | **COURSE CREDIT :** 03 [3-0-0] |
| **DEPARTMENT:** Computer Sc. & Engg. | **CATEGORY: P**C |
| **CODE:** 1113134 | **SEMESTER:** Third |
| **PRE-REQUISITE (If Any):** | |

## SYLLABUS OUTLINE:

**Finite State Machines**: [**4L**]
Definition, concept of sequential circuits, state table & state assignments, concept of synchronous, asynchronous and liner sequential machines.

**Finite State Models**: [**8L**]

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Basic definition, mathematical representation, Moore versus Mealy m/c, capability & limitations of FSM, state equivalence & minimization, machine equivalence, incompletely specified machines, merger graph & compatibility graph, merger table, Finite memory, definite, information loss less & inverse machines: testing table & testing graph.

**Finite Automation**: **[10L]**
Preliminaries (strings, alphabets & languages, graphs & trees, set & relations), definition, recognition of a language by an automata - idea of grammar, DFA, NFA, equivalence of DFA and NFA, NFA with e- moves, regular sets & regular expressions: equivalence with finite automata, NFA from regular expressions, regular expressions from DFA, two way finite automata equivalence with one way, equivalence of Moore & Mealy machines, applications of finite automata.

**Closure Properties of Regular Sets**: **[4L]**
Pumping lemma & its application, closure properties minimization of finite automata: minimization by distinguishable pair, Myhill-Nerode theorem.

**Context Free Grammars:** **[4L]**
Introduction, definition, derivation trees, simplification, CNF & GNF.

**Pushdown Automata**: **[4L]**
Definition, moves, Instantaneous Descriptions, language recognized by PDA, deterministic PDA, acceptance by final state & empty stack, equivalence of PDA and CFL.

**Closure Properties of CFLs**: **[4L]**
Pumping lemma & its applications, Ogden's lemma, closure properties, decision algorithms. Introduction to Z. Regular language properties and their grammars. Context sensitive languages.

**Text Books:**
1. Hopcroft JE. and Ullman JD., "Introduction to Automata Theory, Languages & Computation", Narosa.
2. K.L.P Mishra & N. Chandrasekharan – "Theory of Computer Science", PHI
3. Lewis H. R. and Papadimitrou C. H., "Elements of the theory of Computation", P.H.I.
4. Kain, "Theory of Automata & Formal Language", McGraw Hill.

**Reference Books:**
5. Kohavi ZVI, "Switching & Finite Automata", 2nd Edn., Tata McGraw Hill.
6. Linz Peter, "An Introduction to Formal Languages and Automata", Narosa
7. Ash & Ash – "Discrete Mathematics", TMH

## Foreign Language - I

## COURSE INFORMATION:

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|---|---|
| **SCHOOL :** Engineering & Technology | **COURSE TYPE:** L-T-P |

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|---|---|
| **NAME:** Foreign Language (German/Spanish/Japanese) | **COURSE CREDIT :** 02 [2-0-0] |
| **DEPARTMENT:** Foreign Language - I | **CATEGORY:** MUS |
| **CODE:** 1278131 | **SEMESTER:** Third |
| **PRE-REQUISITE (If Any):** | |

## Mentored Seminar- I

## COURSE INFORMATION:

| | |
|---|---|
| **SCHOOL :** Engineering & Technology | **COURSE TYPE:** |
| **NAME:** Mentored Seminar- I | **COURSE CREDIT :** 01 |
| **DEPARTMENT:** Computer Science & Engineering | **CATEGORY:** PSE |
| **CODE:** 1117331 | **SEMESTER:** Third |
| **PRE-REQUISITE (If Any):** | |

## Engineering Mathematics - IV

## COURSE INFORMATION:

| | |
|---|---|
| **SCHOOL :** Engineering & Technology | **COURSE TYPE:** L-T-P |
| **NAME:** Engineering Mathematics – IV | **COURSE CREDIT :** 03 [3-0-0] |
| **DEPARTMENT:** Computer Sc. & Engg. | **CATEGORY:** BS |
| **CODE:** 1191141 | **SEMESTER:** Fourth |
| **PRE-REQUISITE (If Any): Mathematics -III** | |

## SYLLABUS OUTLINE:

**Numerical Methods:** **[20L]**

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

Interpolation: Newton forward/backward interpolation, Lagrange's and Newton's divided difference Interpolation

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

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Numerical solution of a system of linear equations: Gauss elimination method, Matrix inversion, LU Factorization method, Gauss-Seidel iterative method.
Numerical solution of Algebraic equation: Bisection method, Regula-Falsi method, Newton-Raphson method.
Numerical solution of ordinary differential equation: Euler's method, Runge-Kutta methods, Finite Difference method.

**Theory of Probability:** **[20L]**
Axiomatic definition of probability. Conditional probability. Independent events and related problems. Bayes theorem (Statement only) & its application. One dimensional random variable. Probability distributions-discrete and continuous. Expectation. Binomial, Poisson, Uniform, Exponential, Normal distributions and related problems. t, $\chi 2$ and F-distribution (Definition only). Transformation of random variables. Central Limit Theorem, Law of large numbers (statement only) and their applications. Tchebychev inequalities (statement only) and its application.
Sampling theory: Random sampling. Parameter, Statistic and its Sampling distribution. Standard error of statistic. 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. Point estimation. Interval estimation. Maximum likelihood estimation of parameters (Binomial, Poisson and Normal). Confidence intervals and related problems.
Testing of Hypothesis: Simple and Composite hypothesis. Critical region. Level of significance. Type I and Type II errors. One sample and two sample tests for means and proportions. $\chi 2$ - test for goodness of fit. (5L)

**References:**
1. A. Gupta and S.C. Bose, Mathematical Probability and Statistic, Academic Publishers.
2. W. Mendenhall, R.J. Beaver and B.M. Beaver, Introduction to Probability and Statistics, CENGAGE Learning, 2018, ISBN: 978-81-315-3304-8
3. Banerjee A., De S.K. and Sen S.: Mathematical Probability, U.N. Dhur & Sons.
4. Das N.G.: Statistical Methods, TMH.
5. Murray Spiegel, J. Schiller , R. A. Srinivasan, Debasree Goswami, Probability and Statistics (Schaum's Outline Series) Paperback – 1 Jul 2017.
6. A. Gupta and S. C. Bose, Ann introduction to Numerical Analysis, Academic Publisher, 2013, ISBN: 978-81-89781-92-7
7. M.K.Jain,S.R.K. Iyengar , & R.K.Jain: Numerical Methods for Scientific and Engineering Computation, New Age International Publications(p) Ltd. ISBN 13: 9788122433234
8. K.E. Atkinson. An Introduction to Numerical Analysis, John Wiley & Sons (1989).
9. Probability And Statistical Inference Theory And Practice by D. Bhattacharya and S. Roychowdhury (U.N. Dhur Publications).

## Operating Systems

## COURSE INFORMATION:

| | |
|---|---|
| **SCHOOL :** Engineering & Technology | **COURSE TYPE:** L-T-P |
| **NAME:** Operating Systems | **COURSE CREDIT :** 03 [3-0-0] |

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|---|---|
| **DEPARTMENT:** Computer Sc. & Engg. | **CATEGORY:** PC |
| **CODE:** 1113141 | **SEMESTER:** Fourth |
| **PRE-REQUISITE (If Any):** | |

## SYLLABUS OUTLINE:

**Introduction:** **[10L]**
Introduction to OS, operating system functions, evaluation of OS, Different types of OS: batch, multi-programmed, time-sharing, real-time, distributed, parallel.
System Structure, Computer system operation, I/O structure, storage structure, storage hierarchy, different types of protections, operating system structure (simple, layered, virtual machine), O/S services, system calls, Process Management.

**Processes Management:** **[12L]**
Concept of processes, process scheduling, operations on processes, co-operating processes, interposes communication.
CPU scheduling: scheduling criteria, preemptive & non-preemptive scheduling, scheduling algorithms (FCFS, SJF, RR, and priority), and algorithm evaluation, multi-processor scheduling.
Process Synchronization: background, critical section problem, critical region, synchronization hardware, classical problems of synchronization, semaphores.
Deadlocks: system model, deadlock characterization, methods for handling deadlocks, deadlock prevention, deadlock avoidance, deadlock detection, recovery from deadlock, Storage Management.
Threads: overview, benefits of threads, user and kernel threads.

**Storage Management**: **[14L]**
Memory management: Background, logical vs. physical address space, swapping, contiguous memory allocation, paging, segmentation, segmentation with paging.
Virtual Memory: background, demand paging, performance, page replacement, page replacement algorithms (FCFS, LRU), allocation of frames, thrashing.
File Systems: file concept, access methods, directory structure, file system structure, allocation methods (contiguous, linked, and indexed), and free-space management (bit vector, linked list, grouping), directory implementation (linear list, hash table), efficiency & performance.
I/O Management: I/O hardware, polling, interrupts, DMA, application I/O interface (block and character devices, network devices, clocks and timers, blocking and nonblocking I/O), kernel I/O subsystem (scheduling, buffering, caching, spooling and device reservation, error handling), performance.
Disk Management: disk structure, disk scheduling (FCFS, SSTF, SCAN,C-SCAN) , disk reliability, disk formatting, boot block, bad blocks.
Protection & Security Goals of protection, domain of protection, security problem, authentication, one-time password, program threats, system threats, threat monitoring, encryption.

**Laboratory**

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1. Shell programming: creating a script, making a script executable, shell syntax (variables, conditions, control structures, functions, commands).
2. Process: starting new process, replacing a process image, duplicating a process image, waiting for a process, zombie process.
3. Signal: signal handling, sending signals, signal interface, signal sets.
4. Semaphore: programming with semaphores (use functions semctl, semget, semop, set_semvalue, del_semvalue, semaphore_p, semaphore_v).
5. POSIX Threads: programming with pthread functions (viz. pthread_create, pthread_join, pthread_exit, pthread_attr_init, pthread_cancel)
6. Inter-process communication: pipe, named pipes (FIFOs, accessing FIFO), shared memory.

**Text Books:**
1. Silbersehatz A. Galvin PB, Gang G., "Operating System Concepts", Wiley.
2. Milenkovie M., "Operating System: Concept & Design", McGraw Hill.
3. Tanenbaum A.S., "Operating System Design & Implementation", Practice Hall NJ.

**References:**
3. Dhamdhere, Operating System TMH
4. Stalling, William, "Operating Systems", Maxwell McMillan International Editions, 1992.
5. Dietel H. N., "An Introduction to Operating Systems", Addison Wesley

## Design and Analysis of Algorithm

## COURSE INFORMATION:

| | |
|---|---|
| **SCHOOL :** Engineering & Technology | **COURSE TYPE:** L-T-P |
| **NAME:** Design and Analysis of Algorithm | **COURSE CREDIT :** 04 [3-1-0] |
| **DEPARTMENT:** Computer Sc. & Engg. | **CATEGORY:** PC |
| **CODE:** 1113142 | **SEMESTER:** Fourth |
| **PRE-REQUISITE (If Any): Data Structure and Algorithm** | |

## SYLLABUS OUTLINE:

**Introduction:** **[10L]**
Characteristics of algorithm. Analysis of algorithm: Asymptotic analysis of complexity bounds – best, average and worst-case behaviour; Performance measurements of Algorithm, Time and space trade-offs, Model of computation: RAM, TM and analysis of recursive algorithms through recurrence relations: Substitution method, Recursion tree method and Masters' theorem.

**Fundamental Algorithmic Strategies:** **[10L]**
Brute-Force, Divide and Conquer: merge sort and quick sort, Greedy: Knapsack problem, Job sequencing with deadlines, minimum spanning tree (Prim's and Kruskal's algorithms), Dynamic Programming: matrix chain

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multiplication, Branch-and-Bound: 15-puzzle problem and Backtracking: N-queen problem, methodologies for the design of algorithms; Illustrations of these techniques for Problem-Solving, Bin Packing, Knapsack, TSP. Heuristics –characteristics and their application domains.

**Graph and Tree Algorithms:** **[10L]**
Traversal algorithms: Depth First Search (DFS) and Breadth First Search (BFS); Shortest path algorithms, Transitive closure, Minimum Spanning Tree, Topological sorting, Network Flow Algorithm.

**Tractable and Intractable Problems:** **[10L]**
Computability of Algorithms, Computability classes – P, NP, NP-complete and NP-hard. Cook's theorem, Standard NP-complete problems and Reduction techniques, Circuit Satisfiability problem, Clique Decision Problem.

**Advanced Topics:** **[6L]**
Different types of algorithms and solution of simultaneous equations, DFT & FFT algorithm; integer multiplication schemes, Approximation algorithms, Necessity of approximation scheme, performance guarantee, Polynomial time approximation schemes.

**Laboratory**
1. Graph Theory and Numerical Methods using C.
2. Implementation of Graph algorithms: Single Spanning Tree Generation using - BFS, DFS.
3. Minimal Spanning Tree Generation using - Prim's Algorithm, Kruskal's Algorithm,
4. Shortest Path finding using - Floyd's Algorithm, Floyd-Warshall Algorithm, Dijkstra's Algorithm, Graph Partitioning Algorithm.

**Text Books:**
**1.** Introduction to Algorithms, 4TH Edition, Thomas H Cormen, Charles E Lieserson,
2. Ronald L Rivest and Clifford Stein, MIT Press/McGraw-Hill.
3. Fundamentals of Algorithms – Horowitz Ellis, Sahani Sartaz, R. Sanguthevar
4. The Design and Analysis of algorithms-- A.Aho, J.Hopcroft and J.Ullman

**Reference Books**
5. Algorithm Design, 1ST Edition, Jon Kleinberg and ÉvaTardos, Pearson.
6. Algorithm Design: Foundations, Analysis, and Internet Examples, Second Edition
7. Michael T Goodrich and Roberto Tamassia, Wiley.
8. Algorithms -- A Creative Approach, 3RD Edition, UdiManber, Addison-Wesley, Reading, MA.

## Database Management System

## COURSE INFORMATION:

| | |
|---|---|
| **SCHOOL :** Engineering & Technology | **COURSE TYPE:** L-T-P |
| **NAME:** Database Management System | **COURSE CREDIT :** 04 [3-1-0] |

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**B. Tech Computer Science & Engineering**

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|---|---|
| **DEPARTMENT:** Computer Sc. & Engg. | **CATEGORY:** PC |
| **CODE:** 1113143 | **SEMESTER:** Fourth |
| **PRE-REQUISITE (If Any): Data Structure and algorithm** | |

## SYLLABUS OUTLINE:

**Database System Architecture:** **[4L]**
Data Abstraction, Data Independence, Data Definition Language (DDL),Data Manipulation Language(DML).

**Data models:** **[5L]**
Entity-relationship model, network model, relational and object oriented data models, integrity constraints, data manipulation operations.

**Relational Query Languages:** **[7L]**
Relational algebra, Tuple and domain relational calculus, SQL, DDL and DML constructs, Open source and Commercial DBMS - MYSQL, ORACLE, DB2, SQL server.

**Relational Database Design:** **[7L]**
Domain and data dependency, Armstrong's axioms, Normal forms, dependency preservation, Lossless design.

**Query Processing and Optimization:** **[6L]**
Evaluation of relational algebra expressions, Query equivalence, Join strategies, queries optimization algorithms.

**Storage strategies:** **[4L]**
Indices, B-trees, B+ trees, hashing.

**Transaction processing:** **[5L]**
Concurrency control, ACID property, Serializability of scheduling, Locking and timestamp based schedulers, Multiversion and optimistic Concurrency Control schemes, Database recovery.

**Database Security:** **[5L]**
Authentication, Authorization and access control, DAC, MAC and RBAC models, Intrusion detection, SQL injection.

**Advanced Topics:** **[4L]**
Object oriented and object relational databases, Logical databases, Web databases, Distributed databases, Data warehousing and data mining.

**Text Books:**
1. "Database System Concepts"6th Edition by Abraham Silberschatz, Henry F. Korth, S. Sudarshan,McGraw-Hill.
2."Principles of Database and Knowledge – Base Systems", Vol 1 by J. D. Ullman, Computer Science Press.

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3. Database Management Systems, R.P. Mahapatra, Khanna Publishing House, New Delhi (AICTE Recommended Textbook – 2018)

**Reference Books:**
4."Fundamentals of Database Systems" , 5th Edition by R. Elmasri and S. Navathe,
5.PearsonEducation "Foundations of Databases", Reprint by Serge Abiteboul, Richard Hull, Victor Vianu, Addison-Wesley.

## Financial Management & Economics for Engineers

## COURSE INFORMATION:

| | |
|---|---|
| **SCHOOL :** Engineering & Technology | **COURSE TYPE:** L-T-P |
| **NAME:** Financial Management & Economics for Engineers | **COURSE CREDIT :** 03 [3-0-0] |
| **DEPARTMENT:** Computer Sc. & Engg. | **CATEGORY:** HSM |
| **CODE:** 1246141 | **SEMESTER:** Fourth |
| **PRE-REQUISITE (If Any):** | |

## SYLLABUS OUTLINE:

**Module 1:** **[7L]**
**Introduction:** Introduction to Engineering Economics – Engineering efficiency – Economic efficiency. Scope of Engineering Economics – Elements of Cost, Marginal Cost, Marginal Revenue, Sunk and Opportunity cost, Break Even Analysis, Elementary economic analysis, Demand and Supply.

**Module 2:** **[13L]**
**Financial Accounting:** Accounting principles – basic records depreciation – depreciation methods – preparation and interpretation of profit and loss statement – balance sheet – fixed assets – current assets.

**Module 3:** **[10L]**
**Profit Value Analysis:** Cost volume profit analysis – relevant costs in decision making profit management analysis – break even analysis – margin of safety, Angle of incidence & multi product break even analysis.

**Text Books:**
1. R. Kesavan, C.Elanchezhian and T.Sundar Selwyn, "Engineering Economics and Financial Accounting", Laxmi Publications 2011
2. Maheswaran. S.N., "Management Accounting and Financial Control", Sultan Chand, 2011

**References Books:**
3. James. C., Vanhorn, "Fundamentals of Financial Management" PHI, 2012
4. Charles T.Homgren, "Cost Accounting", PHI, 2012

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**B. Tech Computer Science & Engineering**

## Foreign Language - II

## COURSE INFORMATION:

| | |
|---|---|
| **SCHOOL :** Engineering & Technology | **COURSE TYPE:** L-T-P |
| **NAME:** Foreign Language (German/Spanish/Japanese) | **COURSE CREDIT :** 02 [2-0-0] |
| **DEPARTMENT:** Foreign Language - II | **CATEGORY:** MUS |
| **CODE:** 1278141 | **SEMESTER:** Fourth |
| **PRE-REQUISITE (If Any):** | |

## Mentored Seminar – II

## COURSE INFORMATION:

| | |
|---|---|
| **SCHOOL :** Engineering & Technology | **COURSE TYPE:** |
| **NAME:** Mentored Seminar – II | **COURSE CREDIT :** 01 |
| **DEPARTMENT:** Computer Science & Engineering | **CATEGORY:** PSE |
| **CODE:** 1117341 | **SEMESTER:** Fourth |
| **PRE-REQUISITE (If Any):** | |

## Engineering Mathematics – V

## COURSE INFORMATION:

| | |
|---|---|
| **SCHOOL :** Engineering & Technology | **COURSE TYPE:** L-T-P |
| **NAME:** Engineering Mathematics – V | **COURSE CREDIT :** 03 [3-0-0] |
| **DEPARTMENT:** Computer Sc. & Engg. | **CATEGORY:** BS |
| **CODE:** 1191151 | **SEMESTER:** Fifth |
| **PRE-REQUISITE (If Any): Mathematics – IV** | |

## SYLLABUS OUTLINE:

**Introduction to Operation Research:**

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Origin of OR and its definition. Concept of optimizing performance measure, Types of OR problems, Deterministic vs. Stochastic optimization, Phases of OR problem approach – problem formulation, building mathematical model, deriving solutions, validating model, controlling and implementing solution.

**Linear Programming:**
Linear programming – Examples from industrial cases, formulation & definitions, Matrix form. Implicit assumptions of LPP.
Some basic concepts and results of linear algebra – Vectors, Matrices, Linear Independence / Dependence of vectors, Rank, Basis, System of linear eqns., Hyperplane, Convex set, Convex polyhedron, Extreme points, Basic feasible solutions.
Geometric method: 2-variable case, Special cases – infeasibility, unboundedness, redundancy & degeneracy, Sensitivity analysis.
Simplex Algorithm – slack, surplus & artificial variables, computational details, big-M method, identification and resolution of special cases through simplex iterations.
Duality – formulation, results, fundamental theorem of duality, dual-simplex and primal-dual algorithms.

**Transportation and Assignment problems:**
TP - Examples, Definitions – decision variables, supply & demand constraints, formulation, Balanced & unbalanced situations, Solution methods – NWCR, minimum cost and VAM, test for optimality (MODI method), degeneracy and its resolution.
AP - Examples, Definitions – decision variables, constraints, formulation, Balanced & unbalanced situations, Solution method – Hungarian, test for optimality (MODI method), degeneracy & its resolution.

**PERT – CPM:**
Project definition, Project scheduling techniques – Gantt chart, PERT & CPM, Determination of critical paths, Estimation of Project time and its variance in PERT using statistical principles, Concept of project crashing/time-cost trade-off.

**Queuing Theory:**
Definitions – queue (waiting line), waiting costs, characteristics (arrival, queue, service discipline) of queuing system, queue types (channel vs. phase).
Kendall's notation, Little's law, steady state behaviour, Poisson's Process & queue, Models with examples - M/M/1 and its performance measures; M/M/m and its performance measures; brief description about some special models.

**Simulation Methodology**:
Definition and steps of simulation, random number, random number generator, Discrete Event System Simulation – clock, event list, Application in Scheduling, Queuing systems and Inventory systems.

**Text Book:**
1. Operations Research: An Introduction. H.A. Taha.

**Reference Books:**
2. Linear Programming. K.G. Murthy.

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3. Linear Programming. G. Hadley.
4. Principles of OR with Application to Managerial Decisions. H.M. Wagner.
5. Introduction to Operations Research. F.S. Hiller and G.J. Lieberman.
6. Elements of Queuing Theory. Thomas L. Saaty.
7. Operations Research and Management Science, Hand Book: Edited By A. Ravi Ravindran.
8. Management Guide to PERT/CPM. Wiest & Levy.

## Artificial Intelligence

## COURSE INFORMATION:

| | |
|---|---|
| **SCHOOL :** Engineering & Technology | **COURSE TYPE:** L-T-P |
| **NAME:** Artificial Intelligence | **COURSE CREDIT :** 03 [3-0-0] |
| **DEPARTMENT:** Computer Sc. & Engg. | **CATEGORY:** PC |
| **CODE:** 1113151 | **SEMESTER:** Fifth |
| **PRE-REQUISITE (If Any):** | |

## SYLLABUS OUTLINE:

**Introduction:** **[2L]**
Problems of AI, AI technique, Tic- Tac - Toe problem, games and game playing approaches.

**Intelligent Agents:** **[2L]**
Agents & environment, nature of environment, structure of agents, goal based agents, utility based agents, learning agents.

**Problem Solving:** **[3L]**
Problems, Problem space & search: Defining the problem as state space search, production system, problem characteristics, issues in the design of search programs.

**Search Techniques**: **[4L]**
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:** **[5L]**
Greedy best-first search, A * search, memory bounded heuristic search: local search algorithms & optimization problems: Hill climbing search, simulated annealing search, local beam search, local search for constraint satisfaction problems.

**Adversarial Search:** **[5L]**

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**B. Tech Computer Science & Engineering**

Games, optimal decisions & strategies in games, the minimax search procedure, alpha-beta pruning, additional refinements iterative deepening.

**Knowledge & Reasoning:** **[3L]**
Knowledge representation issues, representation & mapping, approaches to knowledge representation, issues in knowledge representation.

**Using Predicate Logic:** **[3L]**
Representing simple fact in logic, representing instant & ISA relationship, computable functions & predicates, resolution, natural deduction.

**Probabilistic Reasoning:** **[2L]**
Representing knowledge in an uncertain domain, the semantics of Bayesian networks, Dempster-Shafer theory, Fuzzy sets & fuzzy logics.

**Natural Language Processing:** **[3L]**
Introduction, syntactic processing, semantic analysis, discourse & pragmatic processing.

**Learning:** **[2L]**
Forms of learning, inductive learning, learning decision trees, explanation based learning, learning using relevance information, neural net learning & genetic learning.

**Expert Systems:** **[2L]**
Representing and using domain knowledge, expert system shells, knowledge acquisition.

**Text Books:**
1. Artificial Intelligence, Ritch & Knight, TMH
2. Artificial Intelligence: A Modern Approach, Stuart Russel, Peter Norvig, Pearson
3. Introduction to Artificial Intelligence & Expert Systems, Patterson, PHI
4. Poole, Computational Intelligence, OUP

**Reference Books:**
5. Logic & Prolog Programming, Saroj Kaushik, New Age International
6. Expert Systems, Giarranto, VIKAS
7. M.C. Trivedi, Artificial Intelligence, Khanna Publishing House, New Delhi (AICTE Recommended Textbook – 2018)

## Software Engineering

## COURSE INFORMATION:

| | |
|---|---|
| **SCHOOL :** Engineering & Technology | **COURSE TYPE:** L-T-P |
| **NAME:** Software Engineering | **COURSE CREDIT :** 04 [3-1-0] |

**School of Engineering & Technology**
**B. Tech Computer Science & Engineering**

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|---|---|
| **DEPARTMENT:** Computer Sc. & Engg. | **CATEGORY:** PC |
| **CODE:** 1113152 | **SEMESTER:** Fifth |
| **PRE-REQUISITE (If Any):** | |

## SYLLABUS OUTLINE:

**SDLC Models:** **[8L]**
System Concept, System Development Life Cycle, Waterfall Model ,Spiral Model, Feasibility Analysis, Technical Feasibility, Cost- Benefit Analysis, COCOMO model.

**System Design:** **[8L]**
Context diagram and DFD, Problem Partitioning, Top-Down and Bottom-Up design; Decision tree, decision table and structured English; Functional vs. Object- Oriented approach.

**Coding & Documentation:** **[6L]**
Structured Programming, OO Programming, Information Hiding, Reuse, System Documentation.

**Testing:** **[6L]**
Levels of Testing, Integration Testing, Test case Specification, Reliability Assessment, Validation & Verification Metrics, Monitoring & Control.

**Software Project Management:** **[6L]**
Project Scheduling, Staffing, Software Configuration Management, Quality Assurance, Project Monitoring.

**Modelling Techniques:** **[6L]**
Static and dynamic models, why modelling, UML diagrams: Class diagram, interaction diagram: collaboration diagram, sequence diagram, state chart diagram, activity diagram, and implementation diagram.

**Text Books:**
1. Pressman, Software Engineering : A practitioner's approach– (TMH)
2. Pankaj Jalote, Software Engineering- (Wiley-India)
3. N.S. Gill, Software Engineering – (Khanna Publishing House)
4. Rajib Mall, Software Engineering- (PHI)

**Reference Books:**
5. Agarwal and Agarwal, Software Engineering – (PHI)
6. Sommerville, Software Engineering – Pearson
7. Martin L. Shooman, Software Engineering – TMH

## Compiler Design

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**B. Tech Computer Science & Engineering**

## COURSE INFORMATION:

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|---|---|
| **SCHOOL :** Engineering & Technology | **COURSE TYPE:** L-T-P |
| **NAME:** Compiler Design | **COURSE CREDIT :** 03 [3-0-0] |
| **DEPARTMENT:** Computer Sc. & Engg. | **CATEGORY:** PC |
| **CODE:** 1113153 | **SEMESTER:** Fifth |
| **PRE-REQUISITE (If Any): Formal Language and Automata** | |

## SYLLABUS OUTLINE:

**Introduction to Compiling:** **[4L]**
Compilers, Analysis of the source program, the phases of the compiler, Cousins of the compiler.

**Lexical Analysis:** **[5L]**
The role of the lexical analyzer, Tokens, Patterns, Lexemes, Input buffering, Specifications of a token, Recognition of a tokens, Finite automata, from a regular expression to an NFA, From a regular expression to NFA, From a regular expression to DFA, Design of a lexical analyzer generator (Lex).

**Syntax Analysis:** **[5L]**
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), Parser generators (YACC). Error Recovery strategies for different parsing techniques.

**Syntax directed translation:** **[5L]**
Syntax director definitions, Construction of syntax trees, Bottom-up evaluation of S attributed definitions, L attributed definitions, Bottom-up evaluation of inherited attributes.

**Type Checking:** **[5L]**
Type systems, Specification of a simple type checker, Equivalence of type expressions, Type conversions.

**Run time environments:** **[4L]**
Source language issues (Activation trees, Control stack, scope of declaration, Binding of names), Storage organization (Subdivision of run-time memory, Activation records), Storage allocation strategies, Parameter passing (call by value, call by reference, copy restore, call by name), Symbol tables, dynamic storage allocation techniques.

**Intermediate Code Generation:** **[3L]**
Intermediate languages, Graphical representation, Three-address code, Implementation of three address statements (Quadruples, Triples, Indirect triples).

**Code optimization:** **[3L]**

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Introduction, Basic blocks & flow graphs, Transformation of basic blocks, Dag representation of basic blocks, the principle sources of optimization, Loops in flow graph, Peephole optimization.

**Code generations:** **[2L]**
Issues in the design of code generator, a simple code generator, Register allocation & assignment.

**Text Book:**
1.Aho, Sethi, Ulman - "Compiler Principles", Techniques and Tools" - Pearson Education.

**Reference Book:**
2. Holub - "Compiler Design in C" - PHI.

## Elective-I (Open)

## a) Microprocessor and Microcontroller

## COURSE INFORMATION:

| | |
|---|---|
| **SCHOOL :** Engineering & Technology | **COURSE TYPE:** L-T-P |
| **NAME:** Microprocessor and Microcontroller | **COURSE CREDIT :** 04 [3-1-0] |
| **DEPARTMENT:** Computer Sc. & Engg. | **CATEGORY:** OE |
| **CODE:** 1**5151A | **SEMESTER:** Fifth |
| **PRE-REQUISITE (If Any): Digital electronics** | |

## SYLLABUS OUTLINE:

**8086 architecture:** **[6L]**
8086 architecture- functional diagram, Register organization, memory segmentation, programming model, Memory addresses, physical memory organization, Signal descriptions of 8086-common function signals, timing diagrams, Interrupts of 8086.

**Instruction set and assembly language programming of 8086:** **[10L]**
Instruction formats. Addressing modes, instruction set, assembler directives. Macros, Simple programs involving logical, branch and call instructions. Sorting, evaluating arithmetic expressions, string manipulations.

**I/O Interface:** **[7L]**
8255 PPI, various modes of operation and interfacing to 8086, interfacing of key board, display. Stepper motor interfacing, D/A &A/D converter.

**Interfacing With advanced devices:** **[7L]**

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Memory interfacing to 8086, Interrupts of 8086, Vector interrupt table, Interrupt service routine, Serial communication standards, serial data transfer schemes, 8251 USART architecture and Interfacing.

**Introduction to microcontrollers:** **[8L]**
Overview of 8051 microcontroller, Architecture, I/O ports, Memory organization, addressing modes and instruction set of 8051, Simple programs.

**8051 Real Time Control:** **[7L]**
Programming Timer interrupts, programming external hardware interrupts, Programming the serial communication interrupts, Programming 8051 timers and counters.

**Text Books:**
1. D.V.Hall, Microprocessors and Interfacing. TMGH, 2nd edition 2006.
2. Kenneth.J.Ayala. The 8051 microcontroller, 3rd edition, Cengage learning,2010
3. Advanced microprocessors and peripherals-A.K ray and K.M.Bhurchandani, TMH, 2nd edition 2006.

**Reference Books:**
4. The 8051 microcontrollers, architecture and programming and applications-K.Uma Rao, AndhePallavi., Pearson, 2009.
5. Micro computer system 8086/8088 family architecture, programming and design- By Liu and GA Gibson, PHI, 2nd Ed.,
6. Microcontrollers and application, Ajay.V.Deshmukh,TMGH,2005
7. The 8085 microprocessor: Architecture, programming and interfacing- K.Uday Kumar, B.S.Umashankar,2008,Pearson
8. Microprocessors and microcontrollers- S.V.Altaf

## b) Analog and Digital Communication

## COURSE INFORMATION:

| | |
|---|---|
| **SCHOOL :** Engineering & Technology | **COURSE TYPE:** L-T-P |
| **NAME:** Analog and Digital Communication | **COURSE CREDIT :** 04 [3-1-0] |
| **DEPARTMENT:** Computer Sc. & Engg. | **CATEGORY:** OE |
| **CODE:** 1**5151B | **SEMESTER:** Fifth |
| **PRE-REQUISITE (If Any):** | |

## SYLLABUS OUTLINE:

**Unit I:** **[8L]**
**Analog Communication:**

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**B. Tech Computer Science & Engineering**

Introduction to Communication Systems – Modulation – Types – Need for Modulation. Theory of Amplitude Modulation – Evolution and Description of SSB Techniques – Theory of Frequency and Phase Modulation – Comparison of Analog Communication Systems (AM – FM – PM).

**Unit 2:** **[8L]**
**Pulse and Data Communication:**
Pulse Communication: Pulse Amplitude Modulation (PAM) – Pulse Time Modulation (PTM) – Pulse code Modulation (PCM) – Comparison of various Pulse Communication System (PAM – PTM – PCM). Data Communication: History of Data Communication – Standards Organizations for Data Communication- Data Communication Circuits – Data Communication Codes – Data communication Hardware – serial and parallel interfaces.

**Unit 3:** **[8L]**
**Digital Communication:**
Amplitude Shift Keying (ASK) – Frequency Shift Keying (FSK)–Phase Shift Keying (PSK) – BPSK – QPSK – Quadrature Amplitude Modulation (QAM) – 8 QAM – 16 QAM – Bandwidth Efficiency– Comparison of various Digital Communication System (ASK – FSK – PSK – QAM).

**Unit 4:** **[8L]**
**Source and Error Control Coding:**
Entropy, Source encoding theorem, Shannon fano coding, Huffman coding, mutual information, channel capacity, Error Control Coding, linear block codes, cyclic codes – ARQ Techniques..

**Unit 5:** **[8L]**
**Multi-User Radio Communication:**
Global System for Mobile Communications (GSM) – Code division multiple access (CDMA) – Cellular Concept and Frequency Reuse – Channel Assignment and Handover Techniques – Overview of Multiple Access Schemes – Satellite Communication – Bluetooth.

**Text Books:**
1. Wayne Tomasi, ―Advanced Electronic Communication Systems‖, 6th Edition, Pearson Education, 2009.
2. Simon Haykin, ―Communication Systems‖, 4th Edition, John Wiley & Sons, 2004.
3. Rappaport T.S, "Wireless Communications: Principles and Practice", 2nd Edition, Pearson Education, 2007.

**References Books:**
4. H.Taub, D L Schilling and G Saha, ―Principles of Communication‖, 3rd Edition, Pearson Education, 2007.
5. B. P.Lathi, ―Modern Analog and Digital Communication Systems‖, 3rd Edition, Oxford University Press, 2007.
6. Blake, ―Electronic Communication Systems‖, Thomson Delmar Publications, 2002.

## Foreign Language - III

## COURSE INFORMATION:

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**B. Tech Computer Science & Engineering**

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|---|---|
| **SCHOOL :** Engineering & Technology | **COURSE TYPE:** L-T-P |
| **NAME:** Foreign Language (German/Spanish/Japanese) | **COURSE CREDIT :** 02 [2-0-0] |
| **DEPARTMENT:** Foreign Language - III | **CATEGORY:** MUS |
| **CODE:** 1278151 | **SEMESTER:** Fifth |
| **PRE-REQUISITE (If Any):** | |

## Mentored Seminar – III

## COURSE INFORMATION:

| | |
|---|---|
| **SCHOOL :** Engineering & Technology | **COURSE TYPE:** |
| **NAME:** Mentored Seminar – III | **COURSE CREDIT :** 01 |
| **DEPARTMENT:** Computer Science & Engineering | **CATEGORY:** PSE |
| **CODE:** 1117351 | **SEMESTER:** Fifth |
| **PRE-REQUISITE (If Any):** | |

## Project Management and Entrepreneurship Skill

## COURSE INFORMATION:

| | |
|---|---|
| **SCHOOL :** Engineering & Technology | **COURSE TYPE:** L-T-P |
| **NAME:** Project Management and Entrepreneurship Skill | **COURSE CREDIT :** 03 [3-0-0] |
| **DEPARTMENT:** Computer Sc. & Engg. | **CATEGORY:** HSM |
| **CODE:** 1246161 | **SEMESTER:** Sixth |
| **PRE-REQUISITE (If Any):** | |

## SYLLABUS OUTLINE:

**Innovation: What and Why?**
Innovation as a core business process, Sources of innovation, Knowledge push vs. need pull innovations. Class Discussion- Is innovation manageable or just a random gambling activity?

**Building an Innovative Organization**
Creating new products and services, Exploiting open innovation and collaboration, Use of innovation for starting a new venture Class Discussion- Innovation: Co-operating across networks vs. ‘go-it-alone’ approach.

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**Entrepreneurship:**
Opportunity recognition and entry strategies**,** Entrepreneurship as a Style of Management**,** Maintaining Competitive Advantage- Use of IPR to protect Innovation

**Entrepreneurship- Financial Planning:**
Financial Projections and Valuation, Stages of financing, Debt, Venture Capital and other forms of Financing

**Intellectual Property Rights (IPR)**
Introduction and the economics behind development of IPR: Business Perspective, IPR in India – Genesis and Development, International Context, Concept of IP Management, Use in marketing

**Types of Intellectual Property**
Patent- Procedure, Licensing and Assignment, Infringement and Penalty, Trademark- Use in marketing, example of trademarks- Domain name, Geographical Indications- What is GI, Why protect them? Copyright- What is copyright, Industrial Designs- What is design? How to protects, Class Discussion- Major Court battles regarding violation of patents between corporate companies

**Assignment:**
Case study materials book will be given to students. Students are required to meet in groups before coming to class and prepare on the case for the day. Instructor may ask the student groups to present their analysis and findings to the class.
Further, the topic for class discussion will be mentioned beforehand and students should be ready to discuss these topics (in groups) in class. Students are required to meet in groups before coming to class and prepare on the topic. Few topics are mentioned below as examples. Instructor can add or change any topic as per requirement.
Topic 1- Is innovation manageable or just a random gambling activity?
Topic 2- Innovation: Co-operating across networks vs. 'go-it-alone' approach
Topic 3- Major Court battles regarding violation of patents between corporate companies

**Text Books:**
1.Joe Tidd, John Bessant. Managing Innovation: Integrating Technological, Market and Organizational Change
2.Case Study Materials: To be distributed for class discussion.

## Computer Networks

## COURSE INFORMATION:

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|---|---|
| **SCHOOL :** Engineering & Technology | **COURSE TYPE:** L-T-P |
| **NAME:** Computer Networks | **COURSE CREDIT :** 03 [3-0-0] |
| **DEPARTMENT:** Computer Sc. & Engg. | **CATEGORY:** PC |
| **CODE:** 1113161 | **SEMESTER:** Sixth |
| **PRE-REQUISITE (If Any): Analog and Digital Communication** | |

**School of Engineering & Technology**
**B. Tech Computer Science & Engineering**

## SYLLABUS OUTLINE:

**Data Communication Components:** **[4L]**
Representation of data and its flow Networks, Various Connection Topology, Protocols and Standards, OSI model, Transmission Media, LAN: Wired LAN, Wireless LANs, Connecting LAN and Virtual LAN.

**Data Link Layer and Medium Access Sub Layer:** **[10L]**
Error Detection and Error Correction - Fundamentals, Block coding, Hamming Distance, CRC; Flow Control and Error control protocols - Stop and Wait, Go back – N ARQ, Selective Repeat ARQ, Sliding Window, Piggybacking, Random Access, Multiple access protocols -Pure ALOHA, Slotted ALOHA,CSMA/CD,CDMA/CA. Ethernet, WLAN.

**Network Layer:** **[10L]**
Switching, Logical addressing – IPV4, IPV6; Address mapping – and DHCP–Delivery, Forwarding Unicast Routing protocols, Multicast Routing Protocol.

**Transport Layer:** **[6L]**
Process to Process Communication, User Datagram Protocol (UDP), Transmission Control Protocol (TCP)s; Quality of Service, QoS improving techniques: Leaky Bucket and Token Bucket algorithm.

**Application Layer:** **[6L]**
Domain Name Space (DNS), DDNS, TELNET, EMAIL, File Transfer Protocol (FTP), WWW, HTTP, SNMP.

**Text Books:**
1. "Data and Computer Communication" by William Stallings.
2. "Data Communication and Networking" by Behrouz A Forouzan.
3. "Computer Networks" by Andrew S Tanenbaum.

**Reference Books:**
4. "Internetworking with TCP/IP, Volume 1" by Douglas Comer.
5. "TCP/IP Illustrated" by W Richard Stevens.

## Elective-II (Open)

## a) Fuzzy Set Theory And Decision Making

## COURSE INFORMATION:

| | |
|---|---|
| **SCHOOL :** Engineering & Technology | **COURSE TYPE:** L-T-P |
| **NAME:** Fuzzy Set Theory And Decision Making | **COURSE CREDIT :** 04 [3-1-0] |
| **DEPARTMENT:** Computer Sc. & Engg. | **CATEGORY:** OE |

**School of Engineering & Technology**
**B. Tech Computer Science & Engineering**

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|---|---|
| **CODE:** 1**5161A | **SEMESTER:** Sixth |
| **PRE-REQUISITE (If Any):** | |

## SYLLABUS OUTLINE:

**Module 1:** **[5L]**
Classical sets vs Fuzzy Sets - Need for fuzzy sets – Definition and Mathematical representations - Level Sets – Fuzzy functions - Zadeh's Extension Principle.

**Module 2:** **[5L]**
Operations on [0,1] - Fuzzy negation, triangular norms, t-conorms, fuzzy implications, Aggregation Operations, Fuzzy Functional Equations.

**Module 3:** **[8L]**
Fuzzy Binary and n-ary relations - composition of fuzzy relations - Fuzzy Equivalence Relations - Fuzzy Compatibility Relations - Fuzzy Relational Equations.

**Module 4:** **[7L]**
Fuzzy Measures - Evidence Theory - Necessity and Belief Measures - Probability Measures vs Possibility Measures.

**Module 5:** **[8L]**
Fuzzy Decision Making - Fuzzy Relational Inference - Compositional Rule of Inference - Efficiency of Inference - Hierarchical.

**Module 6:** **[7L]**
Fuzzy If-Then Rule Base - Inference Engine - Takagi-Sugeno Fuzzy Systems - Function Approximation Applications

**Text Books:**
1. George J Klir and Bo Yuan, "Fuzzy Sets and Fuzzy Logic : Theory and Applications", Prentice Hall NJ,1995.
2. Timothy J. Ross, "Fuzzy Logic with Engineering Applications", 3rd Edition, Willey, 2010.
3. H.J. Zimmermann, Fuzzy Set Theory and its Applications, Allied Publishers, New Delhi, 1991.

**References Books:**
4. Kevin M Passino and Stephen Yurkovich, Fuzzy Control, Addison Wesley Longman, 1998.
5. Michal Baczynski and Balasubramaniam Jayaram, Fuzzy Implications, Springer Verlag, Heidelberg, 2008.
6. E P Klement, R Mesiar and E. Pap, Triangular norms, Kluwer Academic Press, Dordrecht, 2000.
7. M Grabisch et al., Aggregation Functions, Series - Encyclopedia Of Mathematics And Its Applications, Cambridge University Press, 2009

## b) Robotics

**School of Engineering & Technology**
**B. Tech Computer Science & Engineering**

## COURSE INFORMATION:

| | |
|---|---|
| **SCHOOL :** Engineering & Technology | **COURSE TYPE:** L-T-P |
| **NAME:** Robotics | **COURSE CREDIT :** 04 [3-1-0] |
| **DEPARTMENT:** Computer Sc. & Engg. | **CATEGORY:** OE |
| **CODE:** 1**5161B | **SEMESTER:** Sixth |
| **PRE-REQUISITE (If Any):** | |

## SYLLABUS OUTLINE:

**Introduction:** **[4L]**
Introduction – brief history types classification and usage, Science and Technology of robots, Some useful websites, textbooks and research journals.

**Elements of robots – links, joints, actuators, and sensor:** **[5L]**
Position and orientation of a rigid body, Homogeneous transformations, Representation of joints, link 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, common sensors – encoders, tachometers, strain gauge based force-torque sensors, proximity and distance measuring sensors, and vision.

**Kinematics of serial robots:** **[5L]**
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

**Kinematics of parallel robots:** **[5L]**
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.

**Velocity and static analysis of robot:** **[4L]**
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.

**Dynamics of serial and parallel manipulators:** **[6L]**
Mass and inertia of links, Lagrangian formulation for equations of motion for serial and parallel manipulators, Generation of symbolic equations of motion using a computer, Simulation (direct and inverse) of dynamic

equations of motion, Examples of a planar 2R and four-bar mechanism, Recursive dynamics, Commercially available multi-body simulation software (ADAMS) and Computer algebra software Maple.

**Motion planning and control:** **[6L]**
Joint and Cartesian space trajectory planning and generation, Classical 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 nonlinear control of manipulators.

**Modeling and control of flexible robots:** **[4L]**
Models of flexible links and joints, Kinematic modeling of multilink flexible robots, Dynamics and control of flexible link manipulators, Numerical simulations results, Experiments with a planar two-link flexible manipulator.

**Modeling and analysis of wheeled mobile robots:** **[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.

**Selected advanced topics in robotics:** **[4L]**
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).

**Text Books:**
1. Robotics process Automation, Khanna Publishing House
2. Saha, S.K., "Introduction to Robotics, 2nd Edition, McGraw-Hill Higher Education, New Delhi, 2014

**Reference Book:**
3. Ghosal, A., "Robotics", Oxford, New Delhi, 2006.

## Elective – I (Professional)

## a) Digital Signal Processing

## COURSE INFORMATION:

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|---|---|
| **SCHOOL :** Engineering & Technology | **COURSE TYPE:** L-T-P |
| **NAME:** Digital Signal Processing | **COURSE CREDIT :** 03 [3-0-0] |

**School of Engineering & Technology**
**B. Tech Computer Science & Engineering**

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|---|---|
| **DEPARTMENT:** Computer Sc. & Engg. | **CATEGORY:** PE |
| **CODE:** 1114161A | **SEMESTER:** Sixth |
| **PRE-REQUISITE (If Any):** | |

## SYLLABUS OUTLINE:

**Discrete-time signals and systems:** **[6L]**
Discrete time signals and systems: Sequences; representation of signals on orthogonal basis; Representation of discrete systems using difference equations, Sampling and reconstruction of signals - aliasing; Sampling theorem and Nyquist rate.

**Z-transform:** **[6L]**
Z-Transform, Region of Convergence, Analysis of Linear Shift Invariant systems using z transform, Properties of z-transform for causal signals, Interpretation of stability in z domain, Inverse z-transforms.

**Discrete Fourier Transform:** **[6L]**
Frequency Domain Analysis, Discrete Fourier Transform (DFT), Properties of DFT, Convolution of signals, Fast Fourier Transform Algorithm, Parseval's Identity, Implementation of Discrete Time Systems.

**Design of Digital filters:** **[10L]**
Design of FIR Digital filters: Window method, Park-McClellan's method. Design of IIR Digital Filters: Butterworth, Chebyshev and Elliptic Approximations; Low-pass, Band-pass, Band stop and High-pass filters. Effect of finite register length in FIR filter design. Parametric and non-parametric spectral estimation. Introduction to multi-rate signal processing.

**Applications of Digital Signal Processing:** **[8L]**
Correlation Functions and Power Spectra, Stationary Processes, Optimal filtering using ARMA Model, Linear Mean-Square Estimation, Wiener Filter.

**Text Books:**
1. S. K. Mitra, "Digital Signal Processing: A computer based approach", McGraw Hill, 2011.
2. A.V. Oppenheim and R. W. Schafer, "Discrete Time Signal Processing", Prentice Hall, 1989.
3. J. G. Proakis and D.G. Manolakis, "Digital Signal Processing: Principles, Algorithms And Applications", Prentice Hall, 1997.

**Reference Books:**
4. L. R. Rabiner and B. Gold, "Theory and Application of Digital Signal Processing", Prentice Hall, 1992.
5. J. R. Johnson, "Introduction to Digital Signal Processing", Prentice Hall, 1992.
6. D. J. DeFatta, J. G. Lucas andW. S. Hodgkiss, "Digital Signal Processing", John Wiley & Sons, 1988.

## b) Cryptography and Network Security

**School of Engineering & Technology**
**B. Tech Computer Science & Engineering**

## COURSE INFORMATION:

| | |
|---|---|
| **SCHOOL :** Engineering & Technology | **COURSE TYPE:** L-T-P |
| **NAME:** Cryptography and Network Security | **COURSE CREDIT :** 03 [3-0-0] |
| **DEPARTMENT:** Computer Sc. & Engg. | **CATEGORY:** PE |
| **CODE:** 1114161B | **SEMESTER:** Sixth |
| **PRE-REQUISITE (If Any):** | |

## SYLLABUS OUTLINE:

**Attacks on Computers & Computer Security:** **[4L]**
Introduction, Need for Security, Security approaches, Principles of Security, Types of attack

**Cryptography: Concepts & Techniques:** **[5L]**
Introduction, Plaintext & Cipher text, Substitution Techniques, Transposition Techniques, Encryption & Decryption, Symmetric & Asymmetric key Cryptography, Key Range & Key Size

**Symmetric Key Algorithm:** **[6L]**
Introduction, Algorithm types & Modes, Overview of Symmetric Key Cryptography, DES(Data Encryption Standard) algorithm, IDEA(International Data Encryption Algorithm) algorithm, RC5(Rivest Cipher 5) Algorithm.

**Asymmetric Key Algorithm, Digital Signature and RSA:** **[8L]**
Introduction, Overview of Asymmetric key Cryptography, RSA algorithm, Symmetric & Asymmetric key Cryptography together, Digital Signature, Basic concepts of Message Digest and Hash Function (Algorithms on Message Digest and Hash function not required)

**Internet Security Protocols, User Authentication:** **[5L]**
Basic Concepts, SSL protocol, Authentication Basics, Password, Authentication Token, Certificate based Authentication, Biometric Authentication.

**Electronic Mail Security:** **[4L]**
Basics of mail security, Pretty Good Privacy, S/MIME

**Firewall:** **[4L]**
Introduction, Types of firewall, Firewall Configurations, DMZ Network

**Text Books:**
1. “Cryptography and Network Security”, William Stallings, 2nd Edition, Pearson Education Asia
2. “Cryptography and Network Security” by V.K. Jain, Khanna Publishing House,
3. “Network Security private communication in a public world”, C. Kaufman, R. Perlman and M. Speciner, Pearson.

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4. Cryptography & Network Security: Atul Kahate, TMH.

**Reference Books:**
5. "Network Security Essentials: Applications and Standards" by William Stallings, Pearson.
6. "Designing Network Security", Merike Kaeo, 2nd Edition, Pearson Books
7. "Building Internet Firewalls", Elizabeth D. Zwicky, Simon Cooper, D. Brent Chapman, 2nd Edition, Oreilly .
8. "Practical Unix & Internet Security", Simson Garfinkel, Gene Spafford, Alan Schwartz, 3rd Edition, Oreilly

## c) Advanced Architecture

## COURSE INFORMATION:

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|---|---|
| **SCHOOL :** Engineering & Technology | **COURSE TYPE:** L-T-P |
| **NAME:** Advanced Architecture | **COURSE CREDIT :** 03 [3-0-0] |
| **DEPARTMENT:** Computer Sc. & Engg. | **CATEGORY:** PE |
| **CODE:** 1114161C | **SEMESTER:** Sixth |
| **PRE-REQUISITE (If Any):** | |

## SYLLABUS OUTLINE:

**Computer Architecture and Organization:** **[4L]**
Review, Fundamentals of Computer Design, Technology Trends Cost Performance Analysis.

**Parallel Processing Architectures:** **[6L]**
Taxonomy- SISD, MISD, SIMD, MIMD, PRAM models. Data and Resource Dependencies, Program Partitioning and Scheduling, Control Flow vs. Data Flow.

**Network topologies:** **[4L]**
Static, Dynamic, Types of Networks RISC vs. CISC, Memory Hierarchy, Virtual Memory.

**Pipelining:** **[5L]**
Concepts of Pipelining, Instruction Pipelining, dynamic pipelining, arithmetic pipelines.

**Multiprocessors:** **[4L]**
Multistage Networks, Cache Coherence, Synchronization, Message- passing.

**Vector Processing Principles:** **[5L]**
Instruction types, Compound, Vector Loops, Chaining

**Array Processors:** **[3L]**
Structure, Algorithms

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**Data Flow Architecture:** **[5L]**
Graphs. Petri Nets, Static and Dynamic DFA
VLSI Computations Parallel Programming Models, Languages, Compilers

**Text Books:**
1. Computer Architecture and Parallel Processing- Kai Hwang and A. .Brigggs International Edition, McGraw Hill.
2. Advanced Computer Architecture: D. Sima, T. fountain, P. Kacsuk, Pearson

**Reference Book:**
3. Parallel Computer Architecture: D. Culler, J.P.Singh, A.Gupta, Elsevier

## d) Artificial Neural Network

## COURSE INFORMATION:

| | |
|---|---|
| **SCHOOL :** Engineering & Technology | **COURSE TYPE:** L-T-P |
| **NAME:** Artificial Neural Network | **COURSE CREDIT :** 03 [3-0-0] |
| **DEPARTMENT:** Computer Sc. & Engg. | **CATEGORY:** PE |
| **CODE:** 1114161D | **SEMESTER:** Sixth |
| **PRE-REQUISITE (If Any): Artificial Intelligence** | |

## SYLLABUS OUTLINE:

**Module 1:** Artificial Neural Networks: Basic Concepts, The Biological Neuron, The Artificial Neuron, Characteristics of the Brain, Computation in Terms of Patterns, Pattern Classification
Pattern Association, McCulloch–Pitts Neural Model, Activation Functions: Identity Function, Step Function, The Sigmoid Function, Hyperbolic Tangent Function **[6L]**

**Module 2:** The Perceptron, realization of logic gates: bipolar step function; The Structure, Linear Separability, The XOR Problem, Neural Network Architectures, Single Layer Feed Forward ANNs, Back propagation: Multi-layer Feedforward Net: Architecture, Notational Convention, Activation Functions, The Generalized Delta Rule, Gradient decent, The Backpropagation Algorithm **[10L]**

**Module 3:** Recurrent Networks, Learning by Neural Nets, Supervised Learning, Unsupervised Learning; Competitive Neural Network: MAXNET, K-SOM, LVQ, ART **[8L]**

**Module 4:** Pattern Classifiers: Hebb Nets, Perceptrons, ADALINE, MADALINE, Pattern Associators: Auto-associative Nets, Hetero-associative Nets, Hopfield Networks, Bidirectional Associative Memory: Kosko's BAM **[8L]**

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**Module 5:** Overview of deep neural network, Auto encoders, Convolutional Neural Network, Reinforcement (Deep) Learning: Generative Adversarial Network, Applications. **[4L]**

**Text Books:**
1. Neural Networks a Comprehensive Foundations, Simon Haykin, PHI edition.
2. Artificial Neural Networks – B. Yegnanarayana Prentice Hall of India P Ltd 2005.

**Reference Books:**
3. Neural Networks in Computer Inteligance, Li Min Fu TMH 2003.
4. Neural Networks -James A Freeman David M S Kapura Pearson Education 2004.
5. Introduction to Artificial Neural Systems Jacek M. Zurada, JAICO Publishing House Ed. 2006.

## Elective – II (Professional)

## a) Digital Image Processing

## COURSE INFORMATION:

| | |
|---|---|
| **SCHOOL :** Engineering & Technology | **COURSE TYPE:** L-T-P |
| **NAME:** Digital Image Processing | **COURSE CREDIT :** 03 [3-0-0] |
| **DEPARTMENT:** Computer Sc. & Engg. | **CATEGORY:** PE |
| **CODE:** 1114162A | **SEMESTER:** Sixth |
| **PRE-REQUISITE (If Any):** | |

## SYLLABUS OUTLINE:

**Module 1:** **[5L]**
Introduction to Image processing: Fundamental steps in image processing; Components of image processing system; Pixels; coordinate conventions; Imaging Geometry; Spatial Domain; Frequency Domain; sampling and quantization; Basic relationship between pixels; Applications of Image Processing.

**Module 2:** **[5L]**
Image transforms and its properties – Unitary transform; Discrete Fourier Transform; Discrete Cosine Transform; Walsh Transform; Hadamard Transform;

**Module 3:** **[6L]**
Image Enhancement in spatial domain Basic Gray Level Transformation functions – Image Negatives; Log Transformations; Power-Law Transformations. Piecewise-Linear Transformation Functions: Contrast Stretching; Gray Level Slicing; Bit Plane Slicing; Histogram Processing–Equalization; Specification. Basics of Spatial Filtering – Smoothing: Smoothing Linear Filters; Ordered Statistic Filters; Sharpening: Laplacian; Unsharp Masking and High Boost Filtering.

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**Module 4:** **[6L]**
Image Enhancement in Frequency Domain Basics of Filtering in Frequency Domain, Filters - Smoothing Frequency Domain Filters : Ideal Low Pass Filter; Gaussian Low Pass Filter; Butterworth Low Pass Filter; Sharpening Frequency Domain Filters: Ideal High Pass Filter; Gaussian High Pass Filter; Butterworth High Pass Filter; Holomorphic Filtering.

**Module 5:** **[7L]**
Image Segmentation: Pixel-Based Approach- Multi-Level Thresholding, Local Thresholding, Threshold Detection Method; Region-Based Approach- Region Growing Based Segmentation, Region Splitting, Region Merging, Split and Merge, Edge Detection - Edge Operators; Line Detection, Corner Detection.

**Module 6:** **[7L]**
Morphological Operations Basics of Set Theory; Dilation and Erosion - Dilation, Erosion; Structuring Element; Opening and Closing; Hit or Miss Transformation. Representation and Description Representation - Boundary, Chain codes, Polygonal approximation approaches, Boundary segments.

**Text Books:**
1. A K. Jain, Fundamentals of digital image processing, Prentice Hall of India, 1989.
2. Rafael C. Gonzalez, Richard E. Woods, Digital Image Processing (English) 3rd Edition, Pearson India, 2013.

**References Books:**
3. Al Bovik, The Essential Guide to Image Processing, Academic Press, 2009.
4. Milan Sonka, Vaclav Hlavac and Roger Boyle, Image Processing, Analysis, and Machine Vision, Thomson Learning, 2008.
5. S Jayaraman, S Esakkirajan and T Veerakumar, Digital Image Processing, McGraw Hill Education , 2009.

## b) Embedded System

## COURSE INFORMATION:

| | |
|---|---|
| **SCHOOL :** Engineering & Technology | **COURSE TYPE:** L-T-P |
| **NAME:** Embedded System | **COURSE CREDIT :** 03 [3-0-0] |
| **DEPARTMENT:** Computer Sc. & Engg. | **CATEGORY:** PE |
| **CODE:** 1114162B | **SEMESTER:** Sixth |
| **PRE-REQUISITE (If Any): Microprocessor and microcontroller** | |

## SYLLABUS OUTLINE:

**Module 1:** **[5L]**

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Introduction to Embedded System: Understanding the Basic Concepts, The Typical Embedded System – Characteristics and Quality attributes.

**Module 2:** **[7L]**
Hardware Software Co-Design and Program Modeling – Fundamental Issues, Computational Models- Data Flow Graph, Control Data Flow Graph, State Machine, Sequential Model, Concurrent Model, Object oriented model, UML.

**Module 3:** **[5L]**
Design and Development of Embedded Product – Firmware Design and Development – Design Approaches, Firmware Development Languages.

**Module 4:** **[5L]**
Integration and Testing of Embedded Hardware and Firmware- Integration of Hardware and Firmware. Embedded System Development Environment – IDEs, Cross Compilers, Disassemblers, Decompiles, Simulators, Emulators and Debuggers.

**Module 5:** **[8L]**
RTOS based Design – Basic operating system services. Interrupt handling in RTOS environment. Design Principles. Task scheduling models. How to Choose an RTOS. Case Study – Micro/OS-II.

**Module 6:** **[6L]**
Embedded Product Development Life Cycle – Description – Objectives -Phases – Approaches. Recent Trends in Embedded Computing.

**Text Books:**

1. Shibu K.V., Introduction to Embedded Systems, McGraw Hill Education (India), 2009.
2. Raj Kamal, Embedded Systems: Architecture, Programming and Design, Third Edition, McGraw Hill Education (India).
3. Jean J. Labrose, MicroC OS II: The Real Time Kernel, Second Edition, CRC Press.

**Reference Books:**
4. Steave Heath, Embedded System Design, Second Edition, Elsevier.
5. J Staunstrup and Wayne Wolf, Hardware / Software Co-Design: Principles and Practice, Prentice Hall.

## c) Machine Learning

## COURSE INFORMATION:

| | |
|---|---|
| **SCHOOL :** Engineering & Technology | **COURSE TYPE:** L-T-P |
| **NAME:** Machine Learning | **COURSE CREDIT :** 03 [3-0-0] |

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|---|---|
| **DEPARTMENT:** Computer Sc. & Engg. | **CATEGORY:** PE |
| **CODE:** 1114162C | **SEMESTER:** Sixth |
| **PRE-REQUISITE (If Any): Artificial Intelligence** | |

## SYLLABUS OUTLINE:

**Module I:** **[6L]**
Basic Concepts of Machine Learning, Supervised Learning Versus Unsupervised Learning, Reinforcement Learning, Discriminative Algorithms.

**Module II:** **[8L]**
Introduction to Supervised Learning, Concepts of Linear Algebra, Linear Regression and Logistic Regression, Concepts Bias/ Variance Tradeoff, Prediction Versus Classification Problem, Naive Bayes, Maximum Entropy, Perceptron, Basic Concept of Neural Network, Generative Learning Algorithms, Gradient Descent, Regularization, Feed Forward Neural Network, Back Propagation Neural Network, Gaussian Discriminant Analysis, Concepts of Vectorization, Support Vector Machines

**Module III:** **[7L]**
Model Selection, Underfitting and Overfitting Problem, Bias-Variance as Function of Lambda, Cross Validation, Learning Curves, Error Analysis, Confusion Matrix, Trading off Precision and Recall, ROC Curve, F1-Score and Accuracy Analysis

**Module IV:** **[7L]**
Introduction to Data Processing, ETL, Measurement of Purity, Entropy and Gini Index, Normalization and Standardization, Dimension Reduction, PCA (Principal Components Analysis), ICA (Independent Components Analysis), EM. Mixture of Gaussians, Factor Analysis, Normal Distribution and Gaussian Distribution, Introduction to Unsupervised Learning, Clustering, K-means and Hierarchical Clustering.

**Module V:** **[8L]**
Introduction of Deep Learning, Hidden Markov Model, Genetic Algorithms, Applications of ML in Case Studies.

**Text Books:**
1. C. M. Bishop- “Pattern Recognition and Machine Learning”-: CBS PUBLISHERS & DISTRIBUTORS.
2. Tom M. Mitchell- “Machine Learning”- Mcgraw Higher Ed Publishing.
3. Kevin Murphy, Machine Learning: A Probabilistic Perspective, MIT Press,

**Reference Books:**
4. Alan Moses. Statistical Modeling and Machine Learning for molecular Biology (Editor), CRC Press, 2016.
5. Sushmita Mitra, Sujay Datta, Theodore Perkins, George Michailidis, Introduction to Machine Learning and Bioinformatics, CRC Press,
6. Trevor Hastie, Robert Tibshirani, Jerome Friedman, The Elements of Statistical Learning, Springer

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## Foreign Language - IV

## COURSE INFORMATION:

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|---|---|
| **SCHOOL :** Engineering & Technology | **COURSE TYPE:** L-T-P |
| **NAME:** Foreign Language (German/Spanish/Japanese) | **COURSE CREDIT :** 02 [2-0-0] |
| **DEPARTMENT:** Foreign Language – IV | **CATEGORY:** MUS |
| **CODE:** 1278161 | **SEMESTER:** Sixth |
| **PRE-REQUISITE (If Any):** | |

## Mentored Seminar – IV

## COURSE INFORMATION:

| | |
|---|---|
| **SCHOOL :** Engineering & Technology | **COURSE TYPE:** |
| **NAME:** Mentored Seminar – IV | **COURSE CREDIT :** 02 |
| **DEPARTMENT:** Computer Science & Engineering | **CATEGORY:** PSE |
| **CODE:** 1117361 | **SEMESTER:** Sixth |
| **PRE-REQUISITE (If Any):** | |

## Elective-III (Open)

## a) Fiber Optic communication

## COURSE INFORMATION:

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|---|---|
| **SCHOOL :** Engineering & Technology | **COURSE TYPE:** L-T-P |
| **NAME:** Fiber Optic communication | **COURSE CREDIT :** 04 [3-1-0] |
| **DEPARTMENT:** Computer Sc. & Engg. | **CATEGORY:** OE |
| **CODE:** 1**5171A | **SEMESTER:** Seventh |
| **PRE-REQUISITE (If Any):** | |

## SYLLABUS OUTLINE:

**Module 1:** **[8L]**

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**Overview of optical fiber communication:** The general system, Advantages of optical fiber communication. Optical spectral band. Optical Fiber waveguides: Introduction, Ray theory transmission Total internal reflection, acceptance angle, numerical aperture, skew rays. Electromagnetic mode theory for optical propagation: Electromagnetic waves, modes in a planar guide, phase and group velocity, phase shift with total internal reflection and the evanescent field, goos hanchen shift.

**Module 2:** **[8L]**
**Cylindrical Fiber:** modes, mode coupling, step index fibers Graded index fibers, Single mode Fiber: Cut-off wavelength, Mode field diameter and spot size, effective refractive index, Group delay and mode delay factor, The Gaussian approximation, equivalent step index methods. Signal distortion in optical fibers - Attenuation, Material Absorption, losses in silica glass fibers; Intrinsic absorption, Extrinsic absorption. Linear scattering losses; Ray light scattering, Mie scattering. Non-linear Scattering losses: fiber bending losses; Dispersion, Chromatic dispersion: material dispersion, waveguide dispersion. Intermodal dispersion: Multimode step index fiber, Multimode graded index fiber. Overall fiber dispersion Multimode fiber, Dispersion modified single mode fibers, Dispersion–shifted fiber, dispersion flatted fibers, nonzero-dispersion shifted fibers (MZ-DSF), Polarization: Fiber birefringence, polarization mode dispersion, polarization maintaining fibers, Non-linear effects: Scattering effects, Kerr effects.

**Module 3:** **[8L]**
**Optical sources - Light Emitting Diodes (LEDs):** Structures, light source materials, Quantum Efficiency on LED Power Modulation of a LED, Laser Diodes- models and threshold conditions, laser diode rate equations, External quantum efficiency, resonant frequency, laser diode structures and radiation patterns, single mode lasers modulation of laser diodes, laser lines

**Module 4:** **[8L]**
Source to fiber power launching, Source Output patterns, Power coupling calculation, Power launching versus wavelength, equilibrium numerical aperture. Photo detectors: Physical principles of photodiodes: The PIN photo detector, Avalanche photodiodes. Photo detector Noise: Noise sources, signal to noise ration. Detector Response time: Depletion layer photocurrent, response time structure of in GaAs APDs, Temperature effect on Avalanche gain, comparison of photo detectors.

**Module 5:** **[8L]**
**Optical receiver operation:** Fundamental receiver operation: Digital signal transmission, error sources, front end amplifier. Digital receiver performance: Probability of error receiver sensitivity, The Quantum Unit. Eye Diagram: Eye Pattern Features, BER and Q Factor Measurement Coherent Detection: Fundamental concepts, Homodyne detection, heterodyne detection, IBER comparisons. Digital links: Point to point links, power penalties.

**Text Books:**
1. John M. Senior, “Optical Fiber Communications”, PEARSON, 3rd Edition, 2010.
2. Gerd Keiser, “Optical Fiber Communications”, TMH, 4th Edition, 2008.

**References Books:**
3. Govind P. Agrawal, “Fiber Optic Communication Systems”, John Wiley, 3rd Edition, 2004.

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4. Joseph C. Plais, "Fiber Optic Communication", Pearson Education, 4th Ed, 2004.

## b) Cyber Law

## COURSE INFORMATION:

| | |
|---|---|
| **SCHOOL :** Engineering & Technology | **COURSE TYPE:** L-T-P |
| **NAME:** Cyber Law | **COURSE CREDIT :** 04 [3-1-0] |
| **DEPARTMENT:** Computer Sc. & Engg. | **CATEGORY:** OE |
| **CODE:** 1**5171B | **SEMESTER:** Seventh |
| **PRE-REQUISITE (If Any):** | |

## SYLLABUS OUTLINE:

**Module 1:** **[5L]**
**Introduction of Cybercrime:** What is cybercrime? Forgery, Hacking, Software Piracy, Computer Network intrusion.

**Module 2:** **[5L]**
**Category of Cybercrime:** how criminals plan attacks, passive attack, Active attacks, cyber stalking.

**Module 3:** **[12L]**
**Cybercrime Mobile & Wireless devices:** Security challenges posted by mobile devices, cryptographic security for mobile devices, Attacks on mobile/cellphones, Theft, Virus, Hacking. Bluetooth; Different viruses on laptop

**Module 4:** **[10L]**
**Tools and Methods used in Cybercrime:** Proxy servers, password checking, random checking, Trojan Horses and Backdoors; DOS & DDOS attacks; SQL injection: buffer over flow.

**Module 5:** **[5L]**
**Phishing & Identity Theft:** Phising methods, ID Theft; Online identity method.

**Module 6:** **[5L]**
**Cybercrime & Cyber security:** Legal aspects, Indian laws, IT act, Public key certificate.

**Text Book:**
1. Cyber security by Nina Gobole & Sunit Belapune; Pub: Wiley India.

**References Book:**
2. Information Security & Cyber laws, Gupta & Gupta, Khanna Publishing House

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## c) Web Technology

**COURSE INFORMATION:**

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|---|---|
| **SCHOOL :** Engineering & Technology | **COURSE TYPE:** L-T-P |
| **NAME:** Web Technology | **COURSE CREDIT :** 04 [3-1-0] |
| **DEPARTMENT:** Computer Sc. & Engg. | **CATEGORY:** OE |
| **CODE:** 1**5171C | **SEMESTER:** Seventh |
| **PRE-REQUISITE (If Any): Networking** | |

**SYLLABUS OUTLINE:**

**Introduction:** **[2L]**
Overview, Network of Networks, Intranet, Extranet and Internet.

**World Wide Web:** **[2L]**
Domain and Sub domain, Address Resolution, DNS, Telnet, FTP, HTTP.

**Review of TCP/IP:** **[2L]**
Features, Segment, Three-Way Handshaking, Flow Control, Error Control, Congestion control, IP Datagram, IPv4 and IPv6.

**IP Subnetting and addressing:** **[3L]**
Classful and Classless Addressing, Subnetting. NAT, IP masquerading, IP tables.

**Internet Routing Protocol:** **[2L]**
Routing -Intra and Inter Domain Routing, Unicast and Multicast Routing, Broadcast.

**Electronic Mail:** **[2L]**
POP3, SMTP.

**HTML:** **[3L]**
Introduction, Editors, Elements, Attributes, Heading, Paragraph. Formatting, Link, Head, Table, List, Block, Layout, CSS. Form, Iframe, Colors, Colorname, Colorvalue.

**Image Maps:** **[2L]**
map, area, attributes of image area.

**Extensible Markup Language (XML):** **[2L]**
Introduction, Tree, Syntax, Elements, Attributes, Validation, Viewing. XHTML in brief.

**CGI Scripts:** **[3L]**
Introduction, Environment Variable, GET and POST Methods.

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**PERL:** **[3L]**
Introduction, Variable, Condition, Loop, Array, Implementing data structure, Hash, String, Regular Expression, File handling, I/O handling.

**JavaScript:** **[4L]**
Basics, Statements, comments, variable, comparison, condition, switch, loop, break. Object – string, array, Boolean, reg-ex. Function, Errors, Validation.

**Cookies:** **[2L]**
Definition of cookies, Create and Store a cookie with example.

**Java Applets:** **[2L]**
Container Class, Components, Applet Life Cycle, Update method; Parameter passing applet, Applications.

**Client-Server programming In Java:** **[2L]**
Java Socket, Java RMI.

**Threats:** **[2L]**
Malicious code-viruses, Trojan horses, worms; eavesdropping, spoofing, modification, denial of service attacks.

**Network security techniques:** **[3L]**
Password and Authentication; VPN, IP Security, security in electronic transaction, Secure Socket Layer (SSL), Secure Shell (SSH).

**Firewall:** **[2L]**
Introduction, Packet filtering, Stateful, Application layer, Proxy.

**Internet Telephony:** **[2L]**
Introduction, VoIP.

**Multimedia Applications:** **[2L]**
Multimedia over IP: RSVP, RTP, RTCP and RTSP. Streaming media, Codec and Plugins, IPTV.

**Search Engine and Web Crawler:** **[3L]**
Definition, Meta data, Web Crawler, Indexing, Page rank, overview of SEO.

**Text Book:**
1. Web Technology: A Developer's Perspective, N.P. Gopalan and J. Akilandeswari, PHI Learning, Delhi, 2013.

**Reference Book:**
2. Internetworking Technologies, An Engineering Perspective, Rahul Banerjee, PHI Learning, Delhi, 2011.

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## Elective – III (Professional)

## a) Bioinformatics

## COURSE INFORMATION:

| | |
|---|---|
| **SCHOOL :** Engineering & Technology | **COURSE TYPE:** L-T-P |
| **NAME:** Bioinformatics | **COURSE CREDIT :** 03 [3-0-0] |
| **DEPARTMENT:** Computer Sc. & Engg. | **CATEGORY:** PE |
| **CODE:** 1114171A | **SEMESTER:** Seventh |
| **PRE-REQUISITE (If Any):** | |

## SYLLABUS OUTLINE:

**Unit-1:** **[3L]**
**Cell Biology:** System Biology, Central Dogma, Biological Database: Sequence data, Gene expression data, Micro-array experiment, NCBI database, Challenges faced in the integration of biological data, Data management and data integration in bio-informatics, Issues related to the designing of a biological information system.

**Unit-2:** **[7L]**
**Sequence similarity, homology, and alignment. Pair wise alignment:** Scoring model, dynamic Programming algorithms, heuristic alignment, and pair wise alignment using Hidden Markov models (HMM), Multiple alignment**:** scoring model, local alignment gapped and untapped global alignment. Motif finding: motif models, finding occurrence of known sites, discovering new sites, Amino Acid, Protein, Phylogenetic tree construction: Neighbor Joining Algorithm.

**Unit-3:** **[4L]**
**Biological Pathways:** Gene regulatory network, Transcription factors, Signal Transduction, Protein-Protein interaction, Boolean Network, Stochastic gene networks, Network connectivity.

**Unit-4:** **[13L]**
**Clustering algorithms:** k-means, k-medoid, Isodata, AGNES, DIANA, BIRCH, DBSCAN, CHAMELON, Grid based methods, Model based methods Classifier: Bayes theorem, Naïve Bayes classifier, Baysian belief network, Cluster validity indices: DB-Index, Dunn Index, Xie-Beni Index etc. Association rule Mining: Apriori, FP-Growth.

**Unit-5:** **[9L]**
**Statistical approach:** Information theory (Entropy), Prediction using linear regression, multiple regression, predicting reading frames, maximal dependence decomposition, Expectation-maximization, Bayesian model, Gaussian Mixture Model(GMM), P-value statistics(GO), z-score, t-test, F-test, Validation parameters: True positive, Sensitivity, Specificity, FDR, Accuracy.

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**Text Books:**

1. Molecular Biology of the Cell, Bruce Alberts, Alexander Johnson, Julian Lewis, Martin Raff, Keith Roberts, Peter Walter, New York: Garland Science; 2002
2. Bioinformatics: Sequence and Genome Analysis, David W. Mount, Cold Spring Harbor Laboratory Press
3. Bioinformatics And Functional Genomics: A Short Course, Jonathan Pevsner, Wiley-Liss
4. Data Mining Concepts and tecniques, Han & Kamber,Elsevier.

**Reference Books:**

5. Introduction to Bioinformatics, Arthur M. Lesk, Oxford University Press
6. Developing Bioinformatics Computer Skills,Cynthia Gibas, Per Jambeck,O'Reilly
7. An Introduction to Bioinformatics Algorithms,Neil C. Jones, Pavel A. Pevzner,MIT Press (MA)

## b) Cloud Computing

## COURSE INFORMATION:

| | |
|---|---|
| **SCHOOL :** Engineering & Technology | **COURSE TYPE:** L-T-P |
| **NAME:** Cloud Computing | **COURSE CREDIT :** 03 [3-0-0] |
| **DEPARTMENT:** Computer Sc. & Engg. | **CATEGORY:** PE |
| **CODE:** 1114171B | **SEMESTER:** Seventh |
| **PRE-REQUISITE (If Any):** | |

## SYLLABUS OUTLINE:

**Module 1:** **[9L]**

**Cloud Computing:** Defining a Cloud, Cloud Types – NIST model, Cloud Cube model, Deployment models (Public , Private, Hybrid and Community Clouds),Service Platform as a Service, Software as a Service with examples of services/ service providers, models – Infrastructure as a Service, Cloud Reference model, Characteristics of Cloud Computing – a shift in paradigm Benefits and advantages of Cloud Computing, A brief introduction on Composability, Infrastructure, Platforms, Virtual Appliances, Communication Protocols, Applications, Connecting to the Cloud by Clients, 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:** **[6L]**

**Use of Platforms in Cloud Computing:** Concepts of Abstraction and Virtualization technologies : Types of virtualization (access, application, CPU, storage), Mobility patterns (P2V, V2V, V2P, P2P, D2C, C2C, C2D, D2D) Load Balancing and Virtualization: Basic Concepts, Network resources for load balancing, Advanced load balancing (including Application Delivery Controller and Application Delivery Network), Mention of The

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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).

**Module 3:** **[6L]**

**Porting of applications in the Cloud:** The simple Cloud API and AppZero Virtual Application appliance, Concepts of Platform as a Service, Definition of services, Distinction between SaaS and PaaS (knowledge of Salesforce.com and Force.com), Application Development Use of PaaS Application frameworks, 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., 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, 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:** **[7L]**

**Cloud Infrastructure:**

Cloud Management: 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).

**Concepts of Cloud Security:** Cloud security concerns, Security boundary, Security service boundary Overview of security mapping Security of data: Brokered cloud storage access, Storage location and tenancy, encryption, and auditing and compliance Identity management (awareness of Identity protocol standards)

**Module 5:** **[8L]**

**Concepts of Services and Applications:**

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

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

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

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

**Text Books:**

1. Cloud Computing Bible by Barrie Sosinsky, Wiley India Pvt. Ltd, 2013
2. Mastering Cloud Computing by Rajkumar Buyya, Christian Vecchiola, S. Thamarai Selvi, McGraw Hill Education (India) Private Limited, 2013
3. cloud computing: A practical approach, Anthony T. Velte, Tata Mcgraw-Hill

**References Books:**

4. Cloud Computing – Second Edition by Dr. Kumar Saurabh, Wiley India.

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5. Cloud Computing,Miller,Pearson.

## c) Data Mining

## COURSE INFORMATION:

| | |
|---|---|
| **SCHOOL :** Engineering & Technology | **COURSE TYPE:** L-T-P |
| **NAME:** Data Mining | **COURSE CREDIT :** 03 [3-0-0] |
| **DEPARTMENT:** Computer Sc. & Engg. | **CATEGORY:** PE |
| **CODE:** 1114171C | **SEMESTER:** Seventh |
| **PRE-REQUISITE (If Any):** | |

## SYLLABUS OUTLINE:

**Module 1:** **[6L]**
**Introduction to Data Warehousing; Data Mining:** Mining frequent patterns, association and correlations; Sequential Pattern Mining concepts, primitives, scalable methods;

**Module 2:** **[5L]**
Classification and prediction; Cluster Analysis – Types of Data in Cluster Analysis, Partitioning methods, Hierarchical Methods; Transactional Patterns and other temporal based frequent patterns,

**Module 3:** **[5L]**
Mining Time series Data, Periodicity Analysis for time related sequence data, Trend analysis, and Similarity search in Time-series analysis;

**Module 4:** **[8L]**
Mining Data Streams, Methodologies for stream data processing and stream data systems, Frequent pattern mining in stream data, Sequential Pattern Mining in Data Streams, Classification of dynamic data streams, Class Imbalance Problem; Graph Mining; Social Network Analysis; modulation for communication, filtering, feedback control systems.

**Module 5:** **[6L]**
Web Mining, Mining the web page layout structure, mining web link structure, mining multimedia data on the web, Automatic classification of web documents and web usage mining; Distributed Data Mining.

**Module 6:** **[4L]**
Recent trends in Distributed Warehousing and Data Mining, Class Imbalance Problem; Graph Mining; Social Network Analysis.

**Text Books:**

**School of Engineering & Technology**
**B. Tech Computer Science & Engineering**

1. Data Warehousing Fundamentals for IT Professionals, Second Edition by Paulraj Ponniah, Wiley India.
2. Data Warehousing, Data Mining, & OLAP – Second Edition by Alex Berson and Stephen J. Smith, Tata McGraw Hill Education
3. Data warehouse Toolkit by Ralph Kimball, Wiley India.
4. Data Mining & Warehousing by Ikvinderpal Singh, Khanna Publishing House.

**References Books:**

5. Jiawei Han and M Kamber, Data Mining Concepts and Techniques,, Second Edition, Elsevier Publication, 2011.
6. Vipin Kumar, Introduction to Data Mining - Pang-Ning Tan, Michael Steinbach, Addison Wesley,2006.
7. G Dong and J Pei, Sequence Data Mining, Springer, 2007.

## d) IoT (Internet Of Things)

## COURSE INFORMATION:

| | |
|---|---|
| **SCHOOL :** Engineering & Technology | **COURSE TYPE:** L-T-P |
| **NAME:** IoT (Internet Of Things) | **COURSE CREDIT :** 03 [3-0-0] |
| **DEPARTMENT:** Computer Sc. & Engg. | **CATEGORY:** PE |
| **CODE:** 1114171D | **SEMESTER:** Seventh |
| **PRE-REQUISITE (If Any):** | |

## SYLLABUS OUTLINE:

**Module 1:** **[6L]**
Environmental Parameters Measurement and Monitoring: Why measurement and monitoring are important, effects of adverse parameters for the living being for IOT.

**Module 2:** **[6L]**
Sensors: Working Principles: Different types; Selection of Sensors for Practical Applications Introduction of Different Types of Sensors such as Capacitive, Resistive, Surface Acoustic Wave for Temperature, Pressure, Humidity, Toxic Gas etc.

**Module 3:** **[7L]**
Important Characteristics of Sensors: Determination of the Characteristics Fractional order element: Constant Phase Impedance for sensing applications such as humidity, water quality, milk quality Impedance Spectroscopy: Equivalent circuit of Sensors and Modeling of Sensors Importance and Adoption of Smart Sensors

**Module 4:** **[8L]**

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Architecture of Smart Sensors: Important components, their features Fabrication of Sensor and Smart Sensor: Electrode fabrication: Screen printing, Photolithography, Electroplating Sensing film deposition: Physical and chemical Vapor, Anodization, Sol-gel.

**Module 5:** **[4L]**
Interface Electronic Circuit for Smart Sensors and Challenges for Interfacing the Smart Sensor, Usefulness of Silicon Technology in Smart Sensor and Future scope of research in smart sensor.

**Module 6:** **[5L]**
Recent trends in smart sensor for day to day life, evolving sensors and their architecture.

**Text Books:**
1.Yassura H., Kyung, C.-M., Liu, Y., Lin, Y.-L., Smart Sensors at the IoT Frontier, Springer International Publishing.
2. Kyung, C.-M., Yasuura, H., Liu, Y., Lin, Y.-L., Smart Sensors and Systems, Springer International Publishing

**References Book:**
3. Jeeva Jose, Internet of Things, Khanna Publishing House.

## Elective – IV (Professional)

## a) Soft Computing

## COURSE INFORMATION:

| | |
|---|---|
| **SCHOOL :** Engineering & Technology | **COURSE TYPE:** L-T-P |
| **NAME:** Soft Computing | **COURSE CREDIT :** 03 [3-0-0] |
| **DEPARTMENT:** Computer Sc. & Engg. | **CATEGORY:** PE |
| **CODE:** 1114172A | **SEMESTER:** Seventh |
| **PRE-REQUISITE (If Any):** | |

## SYLLABUS OUTLINE:

**Unit I: Introduction:** **[2L]**
Introduction to soft computing, requirement, soft computing versus hard computing, different tool and techniques and applications. Computational Intelligence versus Machine Learning Basics.

**Unit II: Fuzzy sets and Fuzzy logic systems:** **[10L]**
Introduction, Fuzzy sets versus crisp sets, operations on Classical sets, properties of classical sets, Fuzzy set operations, properties of fuzzy sets, cardinality, operations, Fuzzy relations and properties of fuzzy relations.

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Membership functions: Features of membership functions, standard forms and boundaries, fuzzification, for fuzzy sets, Defuzzification methods: Lamba Cuts, Alpha cuts Fuzzy Logic, Approximate reasoning and Fuzzy Implication. Fuzzy Rule based Systems: Linguistic Hedges, Fuzzy Rule based system – Aggregation of fuzzy Rules, Fuzzy Inference System-Mamdani Fuzzy Models – Sugeno Fuzzy Models.
Applications of Fuzzy Logic, fuzzy logic controllers, fuzzy pattern recognition, fuzzy image processing.

**Unit III: Artificial Neural Network: [10L]**
Introduction and basic models, biological neurons and artificial neural network. Learning Methods: Mc-pitt, Hebb's learning, Perceptron, Adaline and Madaline networks, single layer network, Multilayer feed forward network, Back-propagation network, Different issue regarding convergence multilayer perceptron, Competitive learning, Self-Organizing Maps, Hopfield Networks, Associative Memories, Boltzmann Machine and applications.

**Unit IV: Genetic Algorithm: [8L]**
Introduction, different operators of GA: crossover and mutation, analysis of selection operations, Hypothesis and building block, Multi-objective Genetic Algorithm (MOGA), GA in search and optimization and applications.

**Unit V: Other Soft Computing Technique: [6L]**
Simulated Annealing, Tabu search, Ant colony optimization (ACO), Particle Swarm Optimization (PSO). Hybrid Systems: Neural Network based Fuzzy system, Fuzzy Logic based Neural Networks

**Text Books:**
1. S.N. Sivanandam and S.N. Deepa - "Principles of Soft Computing" - WILEY- INDIA Edition
2. J-Shing Roger Jang, Chuen-Tsai Sun and Eiji Mizutani – "Neuro-Fuzzy and Soft Computing: A Computational Approach to Learning and Machine Intelligence" - Prentice Hall Publishing

**Reference Books:**
3. George J. Klir and Bo Yuan– "Fuzzy Sets and Fuzzy Logic: Theory and Applications" - Prentice Hall Publishing
4. David E. Goldberg– "Genetic Algorithms in search, Optimization & Machine Learning" - Pearson Education India

## b) Natural Language Processing

## COURSE INFORMATION:

| | |
|---|---|
| **SCHOOL :** Engineering & Technology | **COURSE TYPE:** L-T-P |
| **NAME:** Natural Language Processing | **COURSE CREDIT :** 03 [3-0-0] |
| **DEPARTMENT:** Computer Sc. & Engg. | **CATEGORY:** PE |
| **CODE:** 1114172B | **SEMESTER:** Seventh |
| **PRE-REQUISITE (If Any):** | |

**School of Engineering & Technology**
**B. Tech Computer Science & Engineering**

## SYLLABUS OUTLINE:

**Module 1:** **[6L]**
Introduction to NLP, Regular Expression, Finite State Automata
**Tokenization** - Word Tokenization, Normalization, Sentence Segmentation, Named Entity Recognition, Multi Word Extraction, Spell Checking – Bayesian Approach, Minimum Edit Distance.

**Module 2:** **[4L]**
**Morphology** - Morphology – Inflectional and Derivational Morphology, Finite State Morphological Parsing, The Lexicon and Morphotactics, Morphological Parsing with Finite State Transducers, Orthographic Rules and Finite State Transducers, Porter Stemmer.

**Module 3:** **[8L]**
Language Modeling Introduction to N-grams, Chain Rule, Smoothing – Add-One Smoothing, Witten-Bell Discounting; Back off, Deleted Interpolation, N-grams for Spelling and Word Prediction, Evaluation of language models. Hidden Markov Models and POS Tagging Markov Chain, Hidden Markov Models, Forward Algorithm, Viterbi Algorithm, Part of Speech Tagging – Rule based and Machine Learning based approaches, Evaluation.

**Module 4:** **[8L]**
**Text Classification:** Text Classification, Evaluation, Sentiment Analysis – Opinion Mining and Emotion Analysis, Resources and Techniques.
**Context Free Grammar**: Context Free Grammar and Constituency, Some common CFG phenomena for English, Top-Down and Bottom-up parsing, Probabilistic Context Free Grammar, Dependency Parsing.

**Module 5:** **[4L]**
**Computational Lexical Semantics:** Introduction to Lexical Semantics – Homonymy, Polysemy, Synonymy, Thesaurus – WorldNet, Computational Lexical Semantics – Thesaurus based and Distributional Word Similarity.

**Module 6:** **[6L]**
**Information Retrieval:** Boolean Retrieval, Term document incidence, The Inverted Index, Query Optimization, Phrase Queries, Ranked Retrieval – Term Frequency – Inverse Document Frequency based ranking, Zone Indexing, Query term proximity, Cosine ranking, Combining different features for ranking, Search Engine Evaluation, Relevance Feedback.

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

**References Book:**
3. Multilingual Natural Language Processing Applications from Theory to Practice: Bikel, Pearson.

## c) Distributed System

**School of Engineering & Technology**
**B. Tech Computer Science & Engineering**

## COURSE INFORMATION:

| | |
|---|---|
| **SCHOOL :** Engineering & Technology | **COURSE TYPE:** L-T-P |
| **NAME:** Distributed System | **COURSE CREDIT :** 03 [3-0-0] |
| **DEPARTMENT:** Computer Sc. & Engg. | **CATEGORY:** PE |
| **CODE:** 1114172C | **SEMESTER:** Seventh |
| **PRE-REQUISITE (If Any):** | |

## SYLLABUS OUTLINE:

**Unit-1:** **[6L]**
**Introduction:** Examples of Distributed Systems–Trends in Distributed Systems – Focus on resource sharing – Challenges. Case study: World Wide Web.

**Unit-2:** **[7L]**
**Communication in distributed system:** System Model – Inter process Communication – the API for internet protocols – External data representation and Multicast communication. Network virtualization: Overlay networks. Case study: MPI Remote Method Invocation And Objects: Remote Invocation – Introduction – Request-reply protocols – Remote procedure call – Remote method invocation. Case study: Java RMI – Group communication – Publish-subscribe systems – Message queues – Shared memory approaches – Distributed objects – Case study: Enterprise Java Beans -from objects to components.

**Unit-3 :** **[8L]**
**Peer to peer services and file system:** Peer-to-peer Systems – Introduction – Napster and its legacy – Peer-to-peer – Middleware – Routing overlays. Overlay case studies: Pastry, Tapestry- Distributed File Systems – Introduction – File service architecture – Andrew File system. File System: Features-File model -File accessing models – File sharing semantics Naming: Identifiers, Addresses, Name Resolution – Name Space Implementation – Name Caches – LDAP.

**Unit-4:** **[8L]**
**Synchronization and replication:** Introduction – Clocks, events and process states – Synchronizing physical clocks- Logical time and logical clocks – Global states – Coordination and Agreement – Introduction – Distributed mutual exclusion – Elections – Transactions and Concurrency Control– Transactions -Nested transactions – Locks – Optimistic concurrency control – Timestamp ordering – Atomic Commit protocols -Distributed deadlocks – Replication – Case study – Coda.

**Unit-5:** **[7L]**
**Process Management:** Process Migration: Features, Mechanism – Threads: Models, Issues, Implementation. Resource Management: Introduction- Features of Scheduling Algorithms –Task Assignment Approach – Load Balancing Approach – Load Sharing Approach.

**Text Books:**

**School of Engineering & Technology**
**B. Tech Computer Science & Engineering**

1. George Coulouris, Jean Dollimore, Tim Kindberg, "Distributed Systems Concepts and Design", Third Edition, Pearson Education.
2. A.S. Tanenbaum, M. VanSteen, "Distributed Systems", Pearson Education.

**Reference Book:**
3. Mukesh Singhal, "Advanced Concepts in Operating Systems", McGraw-Hill Series in Computer Science.

## Project – I

## COURSE INFORMATION:

| | |
|---|---|
| **SCHOOL :** Engineering & Technology | **COURSE TYPE:** L-T-P |
| **NAME:** Project – I | **COURSE CREDIT :** 03 [0-0-6] |
| **DEPARTMENT:** Computer Science & Engineering | **CATEGORY:** PSE |
| **CODE:** 1117372 | **SEMESTER:** Seventh |
| **PRE-REQUISITE (If Any):** | |

## SYLLABUS OUTLINE:

## Constitution of India

## COURSE INFORMATION:

| | |
|---|---|
| **SCHOOL :** Engineering & Technology | **COURSE TYPE:** L-T-P |
| **NAME:** Constitution of India | **COURSE CREDIT :** 02 [2-0-0] |
| **DEPARTMENT:** Computer Science & Engineering | **CATEGORY:** MUS |
| **CODE:** 1238171 | **SEMESTER:** Seventh |
| **PRE-REQUISITE (If Any):** | |

## SYLLABUS OUTLINE:

**Module 1:** **[3L]**
**Introduction:** Constitution meaning of the term,, Indian Constitution: Sources and constitutional history, Features: Citizenship, Preamble, Fundamental Rights and Duties, Directive Principles of State Policy

**Module 2:** **[6L]**
**Structure of the Union Government:** Federalism center- State relationship, President: Role, power and position, PM and Council of ministers, Cabinet and Central Secretariat, Lok Sabha, Rajya Sabha

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**Module 3:** **[5L]**
**State Government and its Administration Governor:** Role and Position, CM and Council of ministers State secretariat: Organization, Structure and Functions.

**Module 4:** **[7L]**
**Local Administration District's Administration head:** Role and Importance, Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Municipal Corporation, Pachayati raj: Introduction, PRI: Zila Pachayat, Elected officials and their roles, CEO Zila Pachayat: Position and role, Block level: Organizational Hierarchy (Different 4.departments), Village level: Role of Elected and
Appointed officials, Importance of grass root democracy

**Module 5:** **[3L]**
**Election Commission Election Commission:** Role and Functioning, Chief Election Commissioner and Election Commissioners, State Election Commission: Role and Functioning, Institute and Bodies for the welfare of SC/ST/OBC and women.

**Text Books:**
1. 'Indian Polity' by Laxmikanth
2. 'Indian Administration' by Subhash Kashyap

**References Books:**
3. 'Indian Constitution' by D.D. Basu
4. 'Indian Administration' by Avasti and Avasti

## Elective-IV (Open)

## a) Business Analytics

## COURSE INFORMATION:

| | |
|---|---|
| **SCHOOL :** Engineering & Technology | **COURSE TYPE:** L-T-P |
| **NAME:** Business Analytics | **COURSE CREDIT :** 04 [3-1-0] |
| **DEPARTMENT:** Computer Sc. & Engg. | **CATEGORY:** OE |
| **CODE:** 1**5181A | **SEMESTER:** Eighth |
| **PRE-REQUISITE (If Any):** | |

## SYLLABUS OUTLINE:

**Unit 1:** **[6L]**

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**B. Tech Computer Science & Engineering**

Basic statistics about data: central tendency, dispersion, skewness, General Overview of Data Mining and its components, Understanding Business Analytics and R Programming.

**Unit 2:** **[7L]**
Data Processing & Cleaning and Exploration Visualization Techniques, Dimension Reduction Techniques, Principal Component Analysis.

**Unit 3:** **[7L]**
Performance Metrics and Assessment Performance Metrics for Prediction and Classification Supervised learning & Unsupervised Learning

**Unit 4:** **[7L]**
Supervised Learning Methods Multiple Linear Regression, naive bayes theorem, decision trees.

**Unit 5:** **[6L]**
Unsupervised learning techniques, k-means for clustering problems.

**Unit 6:** **[7L]**
Association Rule Learning, Apriori algorithm for association rule learning problems, Simulation & Test - Practical & Theory

**Text Books:**
1. "Data Strategy: How To Profit From A World Of Big Data, Analytics And The Internet Of Things" by Bernard Marr.
2. "Data Science For Business: What You Need To Know About Data Mining And Data-Analytic Thinking" by Foster Provost & Tom Fawcett.
3. "Data Analytics For Beginners: Your Ultimate Guide To Learn And Master Data Analysis. Get Your Business Intelligence Right – Accelerate Growth And Close More Sales" by Victor Finch

**References Books:**
4. "Business Intelligence For Dummies" by Swain Scheps.
5. Business Analytics: Data Analysis & Decision Making by S. Christian Albright and Wayne L. Winston.

## b) Satellite Communication

## COURSE INFORMATION:

| | |
|---|---|
| **SCHOOL :** Engineering & Technology | **COURSE TYPE:** L-T-P |
| **NAME:** Cyber Law | **COURSE CREDIT :** 04 [3-1-0] |
| **DEPARTMENT:** Computer Sc. & Engg. | **CATEGORY:** OE |
| **CODE:** 1**5181B | **SEMESTER:** Eighth |
| **PRE-REQUISITE (If Any):** | |

**School of Engineering & Technology**
**B. Tech Computer Science & Engineering**

## SYLLABUS OUTLINE:

**Module 1:** **[10L]**
**Satellite Orbits:** Kepler‟s Laws, Newton‟s law, orbital parameters, orbital perturbations, station keeping, geo stationary and non-Geo-stationary orbits – Look Angle Determination- Limits of visibility –eclipse-Sub satellite point –Sun transit outage-Launching Procedures – launch vehicles and propulsion.

**Module 2:** **[14L]**
**Space Segment And Satellite Link Design:** Spacecraft Technology- Structure, Primary power, Attitude and Orbit control, Thermal control and Propulsion, communication Payload and supporting subsystems, Telemetry, Tracking and command. Satellite uplink and downlink Analysis and Design, link budget, E/N calculation- performance impairments-system noise, inter modulation and interference, Propagation Characteristics and Frequency considerations- System reliability and design lifetime.

**Module 3:** **[15L]**
**Earth Segment:** Introduction – Receive – Only home TV systems – Outdoor unit – Indoor unit for analog (FM) TV – Master antenna TV system – Community antenna TV system – Transmit – Receive earth stations – Problems – Equivalent isotropic radiated power – Transmission losses – Free-space transmission – Feeder losses – Antenna misalignment losses – Fixed atmospheric and ionospheric losses – Link power budget equation – System noise – Antenna noise – Amplifier noise temperature – Amplifiers in cascade – Noise factor – Noise temperature of absorptive networks – Overall system noise temperature – Carrierto- Noise ratio – Uplink – Saturation flux density – Input back off – The earth station – HPA – Downlink – Output back off – Satellite TWTA output – Effects of rain – Uplink rain– Fade margin – Downlink rain – Fade margin – Combined uplink and downlink C/N ratio – Inter modulation noise.

**Text Books:**
1. Dennis Roddy, “Satellite Communication”, 4th Edition, Mc Graw Hill International, 2006.
2. Wilbur L.Pritchard, Hendri G. Suyderhoud, Robert A. Nelson, “Satellite Communication Systems Engineering”, Prentice Hall/Pearson, 2007.
3. N.Agarwal, “Design of Geosynchronous Space Craft”, Prentice Hall, 1986.
4. Bruce R. Elbert, “The Satellite Communication Applications”, Hand Book, Artech House Bostan London, 1997.

**References Books:**
5. Emanuel Fthenakis, “Manual of Satellite Communications”, Mc Graw Hill Book Co., 1984.
6. Robert G. Winch, “Telecommunication Trans Mission Systems”, Mc Graw-Hill Book Co., 1983.
7. M.Richharia, “Satellite Communication Systems-Design Principles”, Macmillan 2003.

## Elective – V (Professional)

## a) Data Science

**School of Engineering & Technology**
**B. Tech Computer Science & Engineering**

## COURSE INFORMATION:

| | |
|---|---|
| **SCHOOL :** Engineering & Technology | **COURSE TYPE:** L-T-P |
| **NAME:** Data Science | **COURSE CREDIT :** 03 [3-0-0] |
| **DEPARTMENT:** Computer Sc. & Engg. | **CATEGORY:** PE |
| **CODE:** 1114181A | **SEMESTER:** Eighth |
| **PRE-REQUISITE (If Any):** | |

## SYLLABUS OUTLINE:

**Unit 1:** **[5L]**
**Introduction to core concepts and technologies:** Introduction, Terminology, Data & Data Science, Data Analytics, Types of Data, data science process, data science toolkit, Types of data, Example applications.

**Unit 2:** **[5L]**
**Data collection and management:** Introduction, Sources of data, Data collection and APIs, Exploring and fixing data, Data storage and management, Using multiple data sources, **:** Introduction, Terminology and concepts, Introduction to statistics, Central tendencies and distributions, Variance, Distribution properties and arithmetic, Samples/CLT, Data Cleaning & Preparation, Descriptive Statistics & Correlation.

**Unit 3:** **[8L]**
**Data Visualization:** Introduction, Visual Representation of Data, Relational Databases & SQL , Types of data visualization, Data for visualization: Data types, Data encodings, Retinal variables, Mapping variables to encodings, Visual encodings., Data Summarization & Visualization.

**Unit 4:** **[8L]**
**Data analysis** Ethics in Data Mining and Linear Regression, Association Analysis, Principles of Classification; Decision Trees, Linear Classifiers, Neural Network and R, Dimension reduction, PCM, Features Selection from Highly Dimensional Datasets, Evaluate the Performance of Feature Selection Methods, R Scripts to Select Features from Datasets Basic machine learning algorithms: Linear regression, SVM, Naive Bayes.

**Unit 5:** **[7L]**
**Recent Trends and Applications:** Data collection and analysis techniques, various visualization techniques, Build Classification and Prediction Models, Split Data into Training and Test Sets, Perform Cross Validation and Model Evaluation Metrics; Use Model Selection for Explaining Data with Models; Analyze Over fitting and Bias-Variance Trade-off in Prediction Problems, Evaluate Performance of Classification and Prediction Methods, R Scripts to Classify and Predict application development methods of used in data science, case study.

**Text Book:**
1. Cathy O'Neil and Rachel Schutt. Doing Data Science, Straight Talk From The Frontline. O'Reilly.

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**Reference Book:**
2. Jure Leskovek, AnandRajaraman and Jeffrey Ullman. Mining of Massive Datasets. v2.1, Cambridge University Press

## b) Wireless and Sensor Network

## COURSE INFORMATION:

| | |
|---|---|
| **SCHOOL :** Engineering & Technology | **COURSE TYPE:** L-T-P |
| **NAME:** Wireless and Sensor Network | **COURSE CREDIT :** 03 [3-0-0] |
| **DEPARTMENT:** Computer Sc. & Engg. | **CATEGORY:** PE |
| **CODE:** 1114181B | **SEMESTER:** Eighth |
| **PRE-REQUISITE (If Any):** | |

## SYLLABUS OUTLINE:

**Unit 1:** **[10L]**
**Characteristics of WSN:** Characteristic requirements for WSN - Challenges for WSNs – WSN vs Adhoc Networks - Sensor node architecture – Commercially available sensor nodes –Imote, IRIS, Mica Mote, EYES nodes, BTnodes, TelosB, Sunspot -Physical layer and transceiver design considerations in WSNs, Energy usage profile, Choice of modulation scheme, Dynamic modulation scaling, Antenna considerations.

**Unit 2:** **[6L]**
**Medium Access Control Protocols:** Fundamentals of MAC protocols - Low duty cycle protocols and wakeup concepts - Contention based protocols - Schedule-based protocols - SMAC - BMAC - Traffic-adaptive medium access protocol (TRAMA) - The IEEE 802.15.4 MAC protocol.

**Unit 3:** **[10L]**
**Routing Challenges and Design:** Issues in Wireless Sensor Networks, Flooding and gossiping – Data centric Routing – SPIN – Directed Diffusion – Energy aware routing - Gradient-based routing - Rumor Routing – COUGAR – ACQUIRE – Hierarchical Routing - LEACH, PEGASIS – Location Based Routing – GF, GAF, GEAR, GPSR – Real Time routing Protocols – TEEN, APTEEN, SPEED, RAP - Data aggregation - data aggregation operations - Aggregate Queries in Sensor Networks - Aggregation Techniques – TAG, Tiny DB.

**Unit 4:** **[6L]**
**Embedded Operating Systems:** Operating Systems for Wireless Sensor Networks – Introduction - Operating System Design Issues - Examples of Operating Systems – TinyOS – Mate – MagnetOS – MANTIS - OSPM - EYES OS – SenOS – EMERALDS – PicOS – Introduction to Tiny OS – NesC – Interfaces and Modules-Configurations and Wiring - Generic Components -Programming in Tiny OS using NesC, Emulator TOSSIM.

**Unit 5:** **[4L]**

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**Applications of WSN:** WSN Applications - Home Control - Building Automation - Industrial Automation - Medical Applications - Reconfigurable Sensor Networks - Highway Monitoring - Military Applications - Civil and Environmental Engineering Applications - Wildfire Instrumentation - Habitat Monitoring - Nanoscopic Sensor Applications – Case Study: IEEE 802.15.4 LR-WPANs Standard - Target detection and tracking - Contour/edge detection - Field sampling.

**Text Books:**
1. Kazem Sohraby, Daniel Minoli and Taieb Znati, " Wireless Sensor Networks Technology, Protocols, and Applications", John Wiley & Sons, 2007.
2. Holger Karl and Andreas Willig, "Protocols and Architectures for Wireless Sensor Networks", John Wiley & Sons, Ltd, 2005.

**Reference Book:**
3. K. Akkaya and M. Younis, "A survey of routing protocols in wireless sensor networks", Elsevier Ad Hoc Network Journal, Vol. 3, no. 3, pp. 325--349

## c) Mobile Computing

## COURSE INFORMATION:

| | |
|---|---|
| **SCHOOL :** Engineering & Technology | **COURSE TYPE:** L-T-P |
| **NAME:** Mobile Computing | **COURSE CREDIT :** 03 [3-0-0] |
| **DEPARTMENT:** Computer Sc. & Engg. | **CATEGORY:** PE |
| **CODE:** 1114181C | **SEMESTER:** Eighth |
| **PRE-REQUISITE (If Any):** | |

## SYLLABUS OUTLINE:

**Unit-1:** **[6L]**
**Introduction to Personal Communications Services (PCS):** PCS Architecture, Mobility management, Networks signaling. Global System for Mobile Communication (GSM) system overview: GSM Architecture, Mobility management, Network signaling.

**Unit-2:** **[6L]**
**General Packet Radio Services (GPRS):** GPRS Architecture, GPRS Network Nodes. Mobile Data Communication: WLANs (Wireless LANs) IEEE 802.11 standard, Mobile IP.

**Unit-3:** **[6L]**
**Wireless Application Protocol (WAP):** The Mobile Internet standard, WAP Gateway and Protocols, wireless markup Languages (WML). Wireless Local Loop (WLL): Introduction to WLL Architecture, wireless Local Loop Technologies.

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**Unit-4:** **[6L]**
**Mobile Services:** Introduction to International Mobile Telecommunications 2000 (IMT 2000) vision, Wideband Code Division Multiple Access (W-CDMA), and CDMA 2000, Quality of services in 3G.

**Unit-5:** **[5L]**
**Global Mobile Satellite Systems:** Case studies of the IRIDIUM and GLOBALSTAR systems. Wireless Enterprise Networks: Introduction to Virtual Networks, Blue tooth technology, Blue tooth Protocols.

**Unit-6:** **[7L]**
**Introduction to J2ME:** Server-side programming in Java, Pervasive web application architecture, Device independent example application

**Text Books:**
1. "Pervasive Computing", Burkhardt, Pearson
2. "Mobile Communication", J. Schiller, Pearson
3. "Wireless and Mobile Networks Architectures", Yi-Bing Lin & Imrich Chlamtac, John Wiley & Sons, 2001
4. "Mobile and Personal Communication systems and services", Raj Pandya, Prentice Hall of India, 2001.

**Reference Books:**
5. "Guide to Designing and Implementing wireless LANs", Mark Ciampa, Thomson learning, Vikas Publishing House, 2001.
6. "Wireless Web Development", Ray Rischpater, Springer Publishing,
7. "The Wireless Application Protocol", Sandeep Singhal, Pearson.
8. "Third Generation Mobile Telecommunication systems", by P.Stavronlakis, Springer Publishers,

## d) Block Chain and Crypto Currency

## COURSE INFORMATION:

| | |
|---|---|
| **SCHOOL :** Engineering & Technology | **COURSE TYPE:** L-T-P |
| **NAME:** Block Chain and Crypto Currency | **COURSE CREDIT :** 03 [3-0-0] |
| **DEPARTMENT:** Computer Sc. & Engg. | **CATEGORY:** PE |
| **CODE:** 1114181D | **SEMESTER:** Eighth |
| **PRE-REQUISITE (If Any):** | |

## SYLLABUS OUTLINE:

**Module 1:** **[4L]**
**Basics:** Distributed Database, Two General Problem, Byzantine General problem and Fault Tolerance, Hadoop Distributed File System, Distributed Hash Table, ASIC resistance, Turing Complete.

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**B. Tech Computer Science & Engineering**

**Module 2:** **[4L]**
**Cryptography:** Hash function, Digital Signature - ECDSA, Memory Hard Algorithm, Zero Knowledge Proof.

**Module 3:** **[8L]**
**Blockchain:** Introduction, Advantage over conventional distributed database, Blockchain Network, Mining Mechanism, Distributed Consensus, Merkle Patricia Tree, Gas Limit, Transactions and Fee, Anonymity, Reward, Chain Policy, Life of Blockchain application, Soft & Hard Fork, Private and Public blockchain.

**Module 4:** **[7L]**
**Distributed Consensus:** Nakamoto consensus, Proof of Work, Proof of Stake, Proof of Burn, Di_culty Level, Sybil Attack, Energy utilization and alternate.

**Module 5:** **[5L]**
**Cryptocurrency:** History, Distributed Ledger, Bitcoin protocols - Mining strategy and rewards, Ethereum - Construction, DAO, Smart Contract, GHOST, Vulnerability, Attacks, Sidechain, Namecoin.

**Module 6:** **[4L]**
**Cryptocurrency Regulation:** Stakeholders, Roots of Bitcoin, Legal Aspects – Cryptocurrency Exchange, Black Market and Global Economy.

**Module 7:** **[4L]**
**Block-chain Applications:** Internet of Things, Medical Record Management System, Do- main Name Service and future of Block chain.

**Text Books:**
1. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller and Steven Goldfeder, Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction, Princeton University Press (July 19, 2016).
2. Wattenhofer, The Science of the Blockchain
3. Antonopoulos, Mastering Bitcoin: Unlocking Digital Cryptocurrencies.

**References Books:**
4. Satoshi Nakamoto, Bitcoin: A Peer-to-Peer Electronic Cash System.
5. DR. Gavin Wood, \ETHEREUM: A Secure Decentralized Transaction Ledger,"Yellow paper.2014.
6. Nicola Atzei, Massimo Bartoletti, and Tiziana Cimoli, A survey of attacks on Ethereum smart contracts

## Project – II

## COURSE INFORMATION:

| | |
|---|---|
| **SCHOOL :** Engineering & Technology | **COURSE TYPE:** L-T-P |
| **NAME:** Project – II | **COURSE CREDIT :** 06 [0-0-12] |
| **DEPARTMENT:** Computer Science & Engineering | **CATEGORY:** PSE |

**School of Engineering & Technology**
**B. Tech Computer Science & Engineering**

| | |
|---|---|
| **CODE:** 1117382 | **SEMESTER:** Eighth |
| **PRE-REQUISITE (If Any):** | |