Bharatiya Vidya Bhavan's
**Sardar Patel Institute of Technology**
(Autonomous Institute Affiliated to University of Mumbai)
Bhavan's Campus, Munshi Nagar, Andheri (West), Mumbai-400058-India

**Department of Computer Engineering**

# B.Tech. (Computer Engineering) Syllabus (Semester I-V)

# 2021 Iteration (w.e.f. 2021-25)

## Department of Computer Engineering

### Nomenclature of the Courses

| | | | |
|---|---|---|---|
| **BSC** | Basic Science Course | **PC** | Program Core |
| **BSE** | Basic Science Elective | **PE** | Program Elective |
| **ESC** | Engineering Science Course | **MLC** | Mandatory Learning Course |
| **ESE** | Engineering Science Elective | **SCOPE** | Skill Certification for Outcome based Professional Education |
| **SBC** | Skill Based Course | **OE** | Open Elective |
| **ABL** | Activity Based Learning | **HSSE** | Humanities and Social Science Elective |
| **ABL-SEVA** | Social Empowerment Through Various Activities | **ABL-SATVA** | Self- Accomplishment Through Various Activities |

### Abbreviations

| | | | |
|---|---|---|---|
| L | Lecture Hour | O | Other Work (Self Study) |
| T | Tutorial Hour | E | Total Engagement in Hours |
| P | Laboratory Hour | C | Credit Assigned |

### Engagement and Credit Scheme

| **Sem I** | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **No** | **Type** | **Code** | **Course** | **L** | **T** | **P** | **O** | **E** | **C** |
| 1 | BSC | MA101 | Engineering Calculus | 3 | 1 | 0 | 8 | 12 | 4 |
| 2 | BSC | AS102 | Engineering Chemistry | 2 | 0 | 2 | 3 | 07 | 3 |
| 3 | BSC | AS103 | Biology for Engineers | 2 | 0 | 0 | 3 | 05 | 2 |
| 4 | ESC | AS105 | Engineering Mechanics | 2 | 0 | 2 | 4 | 08 | 3 |
| 5 | ESC | CE101 | Problem solving using Imperative Programming | 2 | 0 | 4 | 6 | 12 | 4 |
| 6 | ESC | EC101 | Digital Systems and Microprocessors | 3 | 0 | 2 | 5 | 10 | 4 |
| 7 | SBC | AS107 | Communication Skills | 1 | 0 | 2 | 2 | 05 | 2 |
| **TOTAL** | | | | **15** | **1** | **12** | **31** | **59** | **22** |

| **Sem II** | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **No** | **Type** | **Code** | **Course** | **L** | **T** | **P** | **O** | **E** | **C** |
| 1 | BSC | MA102 | Differential Equations and Complex Analysis | 3 | 1 | 0 | 8 | 12 | 4 |
| 2 | BSC | AS101 | Engineering Physics | 2 | 1 | 2 | 5 | 10 | 4 |
| 3 | ESC | AS104 | Engineering Graphics | 1 | 0 | 2 | 2 | 05 | 2 |
| 4 | ESC | ET101 | Basic Electrical Engineering | 3 | 0 | 2 | 6 | 11 | 4 |
| 5 | ESC | CE102 | Problem Solving using OOP | 2 | 0 | 4 | 4 | 10 | 4 |
| 6 | SBC | AS106 | Skill Shop | 0 | 0 | 2 | 0 | 02 | 1 |
| 7 | ABL | SV1X/ST1X | SEVA-I or SATVA-I | 0 | 0 | 0 | 2 | 02 | 1 |
| **TOTAL** | | | | **11** | **2** | **12** | **27** | **52** | **20** |

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**Department of Computer Engineering**

# Semester-I

# Department of Computer Engineering

| Course (Category) Code | Course Name | Teaching Scheme (Hrs/week) | | | | | Credits Assigned | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | L | T | P | O | E | L | T | P | Total |
| (BSC) | Engineering Calculus | 3 | 1 | 0 | 8 | 12 | 3 | 1 | 0 | 4 |
| | | Examination Scheme | | | | | | | | |
| MA101 | | Component | ISE | | MSE | | ESE | | Total | |
| | | Theory | 100 | | 100 | | 200 | | 400 | |
| | | Laboratory | -- | | -- | | -- | | -- | |

| Pre-requisite Course Codes, if any. | |
|---|---|
| **Course Objective:** To develop mathematical skills for solving engineering problems. | |
| **Course Outcomes (CO):** ***At the End of the course students will be able to: -*** | |
| MA101.1 | Differentiate a function partially. |
| MA101.2 | Find extreme values of a given function. |
| MA101.3 | Find the nth order derivative of a given function. |
| MA101.4 | Expand a given function as a power series. |
| MA101.5 | Calculate the value of integrals in one variable using different technique and solve multiple integrals in various coordinate systems. |
| MA101.6 | Calculate Area using double integration. |

**CO-PO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MA101.1 | 3 | | | | | | | | | | | |
| MA101.2 | 3 | 1 | | | | | | | | | | |
| MA101.3 | 2 | | | | | | | | | | | |
| MA101.4 | 2 | | | | | | | | | | | |
| MA101.5 | 3 | | | | | | | | | | | |
| MA101.6 | 2 | 1 | | | | | | | | | | |

**CO-PEO/PSO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)**

| | PEO1 | PEO2 | PEO3 | PEO4 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|
| MA101.1 | | | | | | |
| MA101.2 | | | | | | |
| MA101.3 | | | | | | |
| MA101.4 | | | | | | |
| MA101.5 | | | | | | |
| MA101.6 | | | | | | |

# Department of Computer Engineering

**BLOOM'S Levels Targeted (Pl. Tick appropriate)**

| Remember ✓ | Understand ✓ | Apply ✓ | Analyze | Evaluate | Create |
|---|---|---|---|---|---|

**Theory Component**

| Module No. | Unit No. | Topics | Ref | Hrs. |
|---|---|---|---|---|
| 1 | Title | **Partial Differentiation** | 1,2,3 | **10** |
| | 1.1 | Partial derivatives of first and higher order. Partial derivatives of composite functions. | | 4 |
| | 1.2 | Euler's theorem for homogeneous functions with two and three independent variables, deductions from Euler's theorem. | | 3 |
| | 1.3 | Application of partial derivatives: i) Local Maxima and Minima of functions of two variables. ii) Lagrange's Method of undetermined multipliers. | | 3 |
| 2 | Title | **Successive Differentiation and Series** | 1,2,3 | **10** |
| | 2.1 | Successive Differentiation: Proofs of nth derivatives of standard functions. Use of De Moivre's theorem and partial fractions to calculate nth derivatives of given functions. | | 3 |
| | 2.2 | Leibnitz's Theorem on nth derivative of product of two functions | | 2 |
| | 2.3 | Infinite series: 1) Maclaurian's series (without proof) and derivation of series of some standard functions using Maclaurin series. Expansion of functions in powers of x by using i) Standard series method ii) Method of differentiation and integration.<br>2) Taylor's series and applications. | | 5 |
| 3 | Title | **Integral Calculus (one variable)** | 1,2,3 | **8** |
| | 3.1 | Gamma functions: properties of gamma functions and integrals reducible to gamma functions. | | 2 |
| | 3.2 | Beta functions: properties, relation between Beta and Gamma functions, integrals reducible to Beta functions, Duplication formula. | | 4 |
| | 3.3 | Differentiation under Integral sign: differentiating integrals with constant limits of integration for one parameter. | | 2 |
| 4 | Title | **Integral Calculus (multi variable)** | 1,2,3 | **14** |
| | 4.1 | Tracing of curves. Sketching standard solids (Spheres, Ellipsoids, Cylinders, Cones, Tetrahedrons, planes) | | 2 |
| | 4.2 | Double Integration: definition and evaluation. Evaluate by changing the order of integration and by changing to polar form. | | 7 |
| | 4.3 | Application of double integral to finding area of given regions. | | 2 |
| | 4.4 | Triple integration: definition and evaluation (Cartesian and cylindrical coordinates). | | 3 |
| 5 | Self-Study | 1.1 Partial differentiation of implicit functions.<br>2.3 Series by method of Substitution<br>3.2 Proof of Duplication Formula | 1,2,3 | **08** |

| | | | | |
|---|---|---|---|---|
| | | 3.3 Differentiation under Integral sign using two parameters and variable limits<br>4.1 Finding lengths of curves in Cartesian and polar form | | |
| | | | **Total** | **42*** |

***Total of 42 hours does not include self-study hours.**

**Text Books**

| Sr. No. | Title | Edition | Authors | Publisher | Year |
|---|---|---|---|---|---|
| 1 | Higher Engineering Mathematics | Forty Fourth | Dr. B. S. Grewal | Khanna Publications | 2020 |

**Reference Books**

| Sr. No. | Title | Edition | Authors | Publisher | Year |
|---|---|---|---|---|---|
| 1 | Advanced Engineering Mathematics | Twenty Eighth | H.K Das | S. Chand | 2014 |
| 2 | Advanced Engineering Mathematics | Tenth | Erwin Kreysizg | John Wiley & Sons | 2011 |
| 3 | Advanced Engineering Mathematics | Fourth | Jain and Iyengar | Narosa Publications | 2014 |

# Department of Computer Engineering

| Course (Category) Code | Course Name | Teaching Scheme (Hrs/week) | | | | | Credits Assigned | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | L | T | P | O | E | L | T | P | Total |
| BSC | Engineering Chemistry | 2 | 0 | 2 | 3 | 7 | 2 | 0 | 1 | 3 |
| | | Examination Scheme | | | | | | | | |
| AS102 | | Component | ISE | | MSE | | ESE | | | Total |
| | | Theory | 50 | | 50 | | 100 | | | 200 |
| | | Laboratory | 50 | | -- | | 50 | | | 100 |

| | |
|---|---|
| **Pre-requisite Course Codes, if any.** | HSC level Chemistry |
| **Course Objective:** To provide necessary background of Chemistry suited for relevant areas of engineering | |
| **Course Outcomes (CO): At *the End of the course students will be able to*** | |
| AS102.1 | Relate thermodynamic principles and laws to crucial applications like heat engines (Understanding) |
| AS102.2 | Summarize properties and applications of different materials like polymers, ceramics, alloys , nanomaterials, conductors and insulators (Understanding) |
| AS102.3 | Identify methods for corrosion control based on knowledge of different types of corrosion and factors affecting rate of corrosion (Application) |
| AS102.4 | Compare different sources of energy like conventional fossil fuels, alternative fuels, batteries and fuel cells with respect to availability, working principles, constitution, efficiency of performance and environmental impact (Understanding) |
| AS102.5 | Apply knowledge of electrochemistry and green chemistry in the interest of public health and environment (Application) |
| AS102.6 | Make use of analytical techniques (complexometric and iodometric titrations) and instruments (pHmeter, conductometer and Orsats's Apparatus) for various purposes like hardness parameters of water, composition of alloys etc. |
| AS102.7 | Estimate key properties of lubricants like flash point, viscosity and acid value |
| AS102.8 | Estimate molecular weight of polymer |

**CO-PO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AS102.1 | 1 | | | | | | | | | | | |
| AS102.2 | 1 | | | | | | | | | | | |
| AS102.3 | 2 | | | | | | | | | | | |
| AS102.4 | 2 | | | | | | 1 | | | | | |
| AS102.5 | 1 | | | | | | 2 | | | | | |
| AS102.6 | | | | 1 | | | | | | | | |
| AS102.7 | | | | 1 | | | | | | | | |
| AS102.8 | | | | 1 | | | | | | | | |

# Department of Computer Engineering

**CO-PEO/PSO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)**

| | PEO1 | PEO2 | PEO3 | PEO4 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|
| AS102.1 | | | | | | |
| AS102.2 | | | | | | |
| AS102.3 | | | | | | |
| AS102.4 | | | | | | |
| AS102.5 | | | | | | |
| AS102.6 | | | | | | |
| AS102.7 | | | | | | |
| AS102.8 | | | | | | |

**BLOOM'S Levels Targeted (Pl. Tick appropriate)**

| Remember | Understand | Apply ✔ | Analyze | Evaluate | Create |
|---|---|---|---|---|---|

**Theory Component**

| Module No. | Unit No. | Topics | Ref. | Hrs. |
|---|---|---|---|---|
| 1 | Title | **Thermodynamics** | | 4 |
| | 1.1 | Introduction, Terminology, Concepts of Internal Energy and Thermodynamic equilibrium, Zeroth and First Law of Thermodynamics, Implications and Limitations of First law | 1,3 | |
| | 1.2 | Concept of Enthalpy, Joule Thomson Effect, Carnot's Cycle, Carnot's theorem and related numericals, Second Law of Thermodynamics | 1,3 | |
| | 1.3 | Applications of thermodynamic principles to the working of refrigerator and air conditioner | 1,3 | |
| 2 | Title | **Polymers** | | 3 |
| | 2.1 | Introduction, Effect of heat on polymers: Glass transition temperature and melting with significance; | 1,2,3 | |
| | 2.2 | Conducting polymers, Liquid crystal polymers, Engineering Polymers | 1,2,3 | |
| 3 | Title | **Corrosion** | | 5 |
| | 3.1 | Introduction, Dry corrosion (i) Due to oxygen (ii) Due to other gases | 1,2 | |
| | 3.2 | Electrochemical corrosion and mechanism, Galvanic, differential aeration corrosion, Significance of galvanic series for corrosion phenomenon | 1,2 | |
| | 3.3 | Factors affecting rate of corrosion<br>(i)Position in galvanic series, (ii) relative areas of anode and cathode, (iii) conductance of medium | 1,2 | |
| | 3.4 | Methods to decrease the rate of corrosion: Material selection, Proper designing, Cathodic protection- i) Sacrificial anodic protection ii) Impressed current method, Metallic coatings, Cathodic and anodic coatings (Galvanization and Tinning: principle and application only) | 1,2 | |

| | | | | |
|---|---|---|---|---|
| 4 | **Title** | **Energy Sciences** | | 5 |
| | **4.1** | Definition and classification of fuels, Calorific value: Definition, Gross or Higher calorific value & Net or lower calorific value, Dulong's formula & numericals for calculations of Gross and Net calorific values. | 1,2 | |
| | **4.2** | Knocking, Octane number, Cetane number, Antiknock agents, unleaded petrol | 1,2 | |
| | **4.3** | Combustion- Calculations for requirement of only oxygen and air (by weight and by volume only) for given solid & gaseous fuels. | 1,2 | |
| | **4.4** | Disadvantages of fossil fuels, Alternative (Green) Fuels: Power alcohol, Biomass, Biogas, Biodiesel, Natural Gas and CNG (Description, Utility, advantages and disadvantages) | 1,2 | |
| 5 | **Title** | **Batteries and Battery Technology** | | 4 |
| | **5.1** | Introduction, Important terms, Nickel-Hydrogen (metal hydride), Rechargeable Lithium-ion batteries | 1,2 | |
| | **5.2** | Reserve Batteries, Fuel cells, characteristics, description, construction and working of Hydrogen-oxygen fuel cells, Types of fuel cells (in brief) | 1,2 | |
| | **5.3** | Electrochemical sensors: Working principle, construction and applications | 1,2 | |
| 6 | **Title** | **Green Chemistry** | | |
| | **6.1** | 12 principles of green chemistry with examples, numericals on Atom Economy, Green Solvents (Water, Supercritical Fluids), | 1,2 | 3 |
| 7 | **Title** | **Engineering Materials** | | |
| | **7.1** | Eutectic mixtures and soft solders, Advanced Ceramic materials and cermets: magnetic, electronic and electrical applications<br>Carbon nanomaterials: Fullerenes and Carbon nanotubes, Structure, Properties and applications | 1,2,3 | 4 |
| | **7.2** | Insulators, Semiconductors and Superconductors: Thermal and electrical insulating materials and important engineering applications, Stoichiometric, defect and controlled valency semiconductors. | 1,2,3 | |
| | **7.3** | Superconductors, perovskite structure and 1:2:3 compound YBa2Cu3O7-y, properties and applications | 1,2,3 | |
| 8 | **Self-Study** | 1. Supramolecular polymers and their applications<br>2. Anodic Protection as a corrosion control strategy<br>3. Current research and advances in fuel cells<br>4. Commercial applications of superconducting materials<br>5. Tops down vs bottoms up approach to nanotechnology and applications of nanoparticles other than carbon | | 4* |
| | | | **Total (* Not Included)** | 28 |

**Laboratory Component**

| Sr. No. | Title of the Experiment |
|---|---|
| 1 | Determination of total, temporary and permanent hardness of water sample |
| 2 | Removal of hardness using ion exchange column |
| 3 | Molecular weight determination of polymers by Oswald's Viscometer |
| 4 | To determine flash point of a lubricating oil |
| 5 | Determination of Viscosity of oil by Redwood Viscometer |
| 6 | Estimation of acid value of lubricant |
| 7 | Determination of amount of strong acid present in a solution using a conductometer |
| 8 | Determination of strength of acid using a pH meter |
| 9 | Estimation of Copper in brass by Iodometric Titration |
| 10 | Analysis of Flue gas for its composition (by Orsat's Apparatus) |
| 11 | Estimation of Iron in plain Carbon steel |
| 12 | Determination of COD of wastewater sample |

**Text Books**

| Sr. No. | Title | Edition | Authors | Publisher | Year |
|---|---|---|---|---|---|
| 1 | Engineering Chemistry | Eleventh | P. C. Jain & M. Jain | Dhanpat Rai & Co. (Pvt) Ltd. | 2014 |
| 2 | A Textbook of Engineering Chemistry | Twelfth | S. S. Dara & S. S. Umare | S. Chand & Co. | 2014 |
| 3 | A Textbook of Engineering Chemistry | Third | S Chawla | Dhanpat Rai & Co. (Pvt) Ltd. | 2015 |

**Reference Books**

| Sr. No. | Title | Edition | Authors | Publisher | Year |
|---|---|---|---|---|---|
| 1 | Physical Chemistry | Eleventh | Peter Atkins | Oxford University Press | 2017 |

# Department of Computer Engineering

| Course (Category) Code | Course Name | Teaching Scheme (Hrs/week) | | | | | Credits Assigned | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | L | T | P | O | E | L | T | P | Total |
| (BSC) | Biology for Engineers | 2 | 0 | 0 | 3 | 5 | 2 | 0 | 0 | 2 |
| | | Examination Scheme | | | | | | | | |
| AS103 | | Component | ISE | | MSE | | ESE | | Total | |
| | | Theory | 50 | | 50 | | 100 | | 200 | |
| | | Laboratory | - | | -- | | - | | - | |

| | |
|---|---|
| **Pre-requisite Course Codes, if any.** | HSC level Biology |
| **Course Objective:** To provide engineering perspective towards the biological principles and systems | |
| **Course Outcomes (CO): At *the End of the course students will be able to*** | |
| AS103.1 | Understand basic biological principles and organizational structure of living systems at molecular level. |
| AS103.2 | Comprehend basic biological principles and organizational structure of living systems at cellular level |
| AS103.3 | Know Energy transformation and information processing in biological systems |
| AS103.4 | Appreciate biological process with engineering perspective |
| AS103.5 | Identify significance of Gene, Blood and Skin in human health system. |

**CO-PO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AS103.1 | 3 | | | | | | | | | | | |
| AS103.2 | 3 | | | | | | | | | | | |
| AS103.3 | 2 | | | | | | | | | | | |
| AS103.4 | 2 | 1 | | | | | | | | | | |
| AS103.5 | 2 | 1 | | | | | | | | | | |

**CO-PEO/PSO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)**

| | PEO1 | PEO2 | PEO3 | PEO4 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|
| AS103.1 | | | | | | |
| AS103.2 | | | | | | |
| AS103.3 | | | | | | |
| AS103.4 | | | | | | |
| AS103.5 | | | | | | |

**BLOOM'S Levels Targeted (Pl. Tick appropriate)**

| Remember | Understand | Apply | Analyze | Evaluate | Create |
|---|---|---|---|---|---|
| ✓ | ✓ | ✓ | | | |

# Department of Computer Engineering

**Theory Component**

| Module No. | Unit No. | Topics | Ref. | Hrs. |
|---|---|---|---|---|
| 1 | **Title** | **Bio-molecules and bio-polymers:** Structure and Function | 1,3 | 4 |
| | **1.1** | Organic and inorganic molecules, Unique Properties of water | | |
| | **1.2** | Carbohydrates, Lipids, Amino Acids and proteins, Nucleic Acids (DNA and RNA) | | |
| 2 | **Title** | **Levels of organization of life** | 1,3 | 4 |
| | **2.1** | Cell as a basic unit of life, prokaryotic and eukaryotic cells, microbes, plant and animal cells; Cell organelles – structure and function; Cell membrane. | | |
| | **2.2** | **Levels of organization:** cells, tissues, organs, systems & organism | | |
| 3 | **Title** | **Energy transformations** | 1,3 | 5 |
| | **3.1** | **Energy transformations in Chloroplast:** Photosynthesis (photochemical & biochemical phase) and ATP generation, Aerobic and anaerobic systems | | |
| | **3.2** | **Energy transformations in Mitochondria:** Cellular respiration (glycolysis and Kreb cycle) and ATP generation | | |
| 4 | **Title** | **Transport and Defense mechanisms** | 1,3 | 5 |
| | **4.1** | **Transport Phenomena in Biological Systems:** Membrane channels and ion channels; Fluid flow and mass transfer (nutrients & ions); In plants: Xylem and Phloem; In animals: Blood and Lymph Transport of gases: Oxygen and Carbon dioxide Heat Transport - Body temperature regulation. | | |
| | **4.2** | **Defense mechanisms:**<br>In plants: Herbivory, secondary metabolites<br>In animals: Innate and Adaptive immune systems | | |
| 5 | **Title** | **Engineering perspectives of biological sciences:** | 1,3 | |
| | **5.1** | Biology and engineering crosstalk –<br>At cell level: Hybridoma technology<br>At tissue level: Plant Tissue Culture, Animal Tissue Culture; | | 6 |
| | **5.2** | Tissue Engineering: Principles, methods and applications Introduction to Biomimetics and Bio-mimicry, nano-biotechnology | | |
| 6 | **Title** | **Role of Gene, Blood and Skin in human health system.** | 2,4 | 4 |
| | **6.1** | Introduction to Genetic Engineering. Blood Type, Complete Blood Count Test and Abnormalities. | | |
| | **6.2** | Structure of Skin, Functions of Skin. Engineering methods for identification of Skin diseases. | | |
| 7 | **Self-Study** | Introduction to Biosensors, transducers, amplifiers; Introduction to medical imaging and different medical Imaging modalities; Review of Signals and system; Electro Physiological Signal Analysis. | | **4*** |
| | | | **Total (* Not included)** | **28** |

**Text Books**

| Sr. No. | Title | Edition | Authors | Publisher | Year |
|---|---|---|---|---|---|
| 1 | Molecular Cell Biology | Fourth | Lodish H, Berk A, Zipursky SL | W. H. Freeman | 2000 |
| 2 | Textbook of Anatomy and Physiology for Nurses and allied Health Sciences | First | Indu Khurana & Arushi | CBS Publsihers & Distributors Pvt Ltd | 2019 |

**Reference Books**

| Sr. No. | Title | Edition | Authors | Publisher | Year |
|---|---|---|---|---|---|
| 3 | Lehninger Principles of Biochemistry | Fourth | Nelson, D. L., & Cox, M. M. | Freeman | 2004 |
| 4 | Introduction to Biomedical Engineering. | Third | Joseph D. Bronzino, John Enderle | Academic Press | 2012 |

# Department of Computer Engineering

| Course (Category) Code | Course Name | Teaching Scheme (Hrs/week) | | | | | Credits Assigned | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | L | T | P | O | E | L | T | P | Total |
| (ESC) | Engineering Mechanics | 2 | 0 | 2 | 4 | 8 | 2 | 0 | 1 | 3 |
| | | Examination Scheme | | | | | | | | |
| | | Component | ISE | | MSE | | ESE | | | Total |
| AS105 | | Theory | 50 | | 50 | | 100 | | | 200 |
| | | Laboratory | 50 | | -- | | 50 | | | 100 |

| Pre-requisite Course Codes, if any. | |
|---|---|
| **Course Objective:** To provide knowledge of force analysis methods required in engineering applications and solutions. Also, to develop analytical and computational ability. | |
| **Course Outcomes (CO): At *the End of the course students will be able to*** | |
| AS105.1 | Draw free body diagram and determine reactive forces using conditions of equilibrium and Lami's theorem |
| AS105.2 | Determine coefficient of friction for various contact surfaces |
| AS105.3 | Analyze the three-dimensional system of space forces. |
| AS105.4 | Analyze the kinematics of particle and obtain the various parameters of motion. |
| AS105.5 | Determine Instantaneous centre of rotation (ICR). |
| AS105.6 | Design and conduct an experiment to demonstrate principles of statics and dynamics |

**CO-PO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AS105.1 | 3 | 3 | | | | | | | | | | |
| AS105.2 | 3 | 3 | | | | | | | | | | |
| AS105.3 | 3 | 3 | | | | | | | | | | |
| AS105.4 | 3 | 3 | | | | | | | | | | |
| AS105.5 | 3 | 3 | | | | | | | | | | |
| AS105.6 | 3 | 3 | | | | | | | | | | |

**CO-PEO/PSO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)**

| | PEO1 | PEO2 | PEO3 | PEO4 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|
| AS105.1 | 3 | | | | | |
| AS105.2 | 3 | | | | | |
| AS105.3 | 3 | | | | | |
| AS105.4 | 3 | | | | | |
| AS105.5 | 3 | | | | | |
| AS105.6 | 3 | | | | | |

**BLOOM'S Levels Targeted (Pl. Tick appropriate)**

| Remember | Understand | A Apply ✓ | Analyze | Evaluate | Create |
|---|---|---|---|---|---|

# Department of Computer Engineering

**Theory Component**

| Module No. | Unit No. | Topics | Ref. | Hrs. |
|---|---|---|---|---|
| **1** | **Unit1** | **Equilibrium of forces** | | **8** |
| | **1.1** | Equilibrant force, conditions of equilibrium for concurrent forces, parallel forces and general force system, equilibrium of connected bodies, Lami's theorem. | 1,3 | |
| | **1.2** | Types of supports, types of loads, Beams, Determination of reactions at supports for various types of loads on beams | 3 | |
| **2** | **Unit2** | **Friction** | | **4** |
| | **2.1** | Introduction to Laws of friction, Cone of friction, Equilibrium of bodies on inclined plane, Application to problems involving wedges, ladders. | 1,2 | |
| **3** | **Unit3** | **Forces in space** | | **5** |
| | **3.1** | Rectangular Components of Forces in Space, Resultant of Space forces, Moment of a Force about a point, axis and line. Equilibrium of a particle in space. | 1 | |
| **4** | **Unit4** | **Kinematics of Particle** | | **8** |
| | **4.1** | Motion along straight and curved path, rectangular component of velocity and acceleration, Tangential & Normal component of acceleration, Motion curves (a-t, v-t, s-t curves), Projectile motion, | 2,3 | |
| **5** | **Unit5** | **Kinematics of Rigid Bodies** | | **3** |
| | **5.1** | Instantaneous center of rotation for the velocity of bodies in plane motion, (up to 2 linkage mechanism) | 3 | |
| **6** | **Self-Study** | 1. Applications of resultant of forces, concept of couple and moments,<br>2. Centroid and center of gravity, analysis of trusses.<br>3. Kinetics of rigid body, work energy principle.<br>4. Principle of Law of Conservation of momentum, Impact and collision. | 1,2,3 | **6*** |
| | | | **Total (*Not included)** | **28** |

**Laboratory Component**

| Sr. No. | Title of the Experiment |
|---|---|
| **1** | Draw the force polygon and determine the equilibrant force for concurrent coplanar force system. |
| **2** | Use the conditions of equilibrium for parallel force system and determine the support reactions. |
| **3** | Apply the principle of moment for equilibrium of levers. |
| **4** | Determine the coefficient of friction for glass slab and a metal plate on an inclined plane. |

| | |
|---|---|
| **5** | Determine the axial forces using Lami's theorem for Jib crane apparatus. |
| **6** | Use the conditions of equilibrium for non-concurrent non-parallel force system and draw the force polygon. |
| **7** | Measure the acceleration due to gravity with the help of simple pendulum apparatus. |
| **8** | Determine the range of projectile and the time of flight for the projectile motion. |
| **9** | Verify the law of conservation of momentum and determine the coefficient of restitution for collision |
| **10** | (Plot the motion of projectile using air-cushion table apparatus.) A small project based on Engineering Mechanics concept. |

**Text Books**

| Sr. No. | Title | Edition | Authors | Publisher | Year |
|---|---|---|---|---|---|
| 1 | Vector Mechanics for Engineers statics and dynamics | Nineth | Beer and Johnston | McGraw Hill | 2010 |
| 2 | Engineering Mechanics | Fifth | Bhavikatti S and Rajsekharappa | New Age International | 2009 |
| 3 | Engineering Mechanics Statics and Dynamics | Fourteenth | A K Tayal | Umesh Publication, Delhi | 2012 |

**Reference Books**

| Sr. No. | Title | Edition | Authors | Publisher | Year |
|---|---|---|---|---|---|
| 1 | Engineering Mechanic: Statics and Dynamics, | Fifth | E.W. Nelson, C.L. Best, W.G. McLean, | McGraw Hill | 1998 |
| 2 | Singer's Engineering Mechanics Statics and Dynamics | Third | Vijaya Kumar Reddy. K. and Suresh Kumar. J | BS Publication | 2012 |

# Department of Computer Engineering

| Course (Category) Code | Course Name | Teaching Scheme (Hrs/week) | | | | | Credits Assigned | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | L | T | P | O | E | L | T | P | Total |
| (ESC) | Problem Solving using Imperative Programming | 2 | 0 | 4 | 4 | 10 | 2 | 0 | 2 | 4 |
| | | Examination Scheme | | | | | | | | |
| | | Component | ISE | | MSE | | ESE | | | Total |
| CE101 | | Theory | - | | - | | - | | | - |
| | | Laboratory | 300 | | -- | | 100 | | | 400 |

| Pre-requisite Course Codes, if any. | |
|---|---|
| **Course Objective:** To develop problem solving skills using imperative programming. | |
| **Course Outcomes (CO): At *the End of the course students will be able to*** | |
| CE101.1 | Explain the problem-solving aspects using various programming paradigms. |
| CE101.2 | Solve real world problems using imperative programming approach. |
| CE101.3 | Solve problems using control structures for real world problems. |
| CE101.4 | Solve problems using Arrays and Text processing. |
| CE101.5 | Develop modular code for a given problem. |
| CE101.6 | Solve real world problems using Structures and Unions |

**CO-PO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CE101.1 | 1 | | | | | | | | | | | |
| CE101.2 | 2 | 2 | | | | | | | | | | |
| CE101.3 | 2 | 2 | | | | | | | | | | |
| CE101.4 | 2 | 2 | | | | | | | | | | |
| CE101.5 | 2 | 2 | | | | | | | | | | |
| CE101.6 | 2 | 2 | | | | | | | | | | |

**CO-PEO/PSO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)**

| | PEO1 | PEO2 | PEO3 | PEO4 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|
| CE101.1 | 1 | 1 | 1 | | | | 1 |
| CE101.2 | 1 | 1 | 1 | | | 1 | 1 |
| CE101.3 | 1 | 1 | 1 | | | 1 | 1 |
| CE101.4 | 1 | 1 | 1 | | | 1 | 1 |
| CE101.5 | 1 | 1 | 1 | | | 1 | 1 |
| CE101.6 | 1 | 1 | 1 | | | 1 | 1 |

**BLOOM'S Levels Targeted (Pl. Tick appropriate)**

| Remember | Understand | Apply ✓ | Analyze | Evaluate | Create |
|---|---|---|---|---|---|

# Department of Computer Engineering

**Theory Component**

| Module No. | Unit No. | Topics | Ref. | Hrs. |
|---|---|---|---|---|
| 1 | **Title** | **Introduction to Problem Solving and Programming Paradigms** | | |
| | **1.1** | What is a Problem, Problem Solving Aspect, Top-Down Design, Implementation of Algorithms, Characteristics of a good algorithm, what is a computer program, real life examples of programming, Computer based applications of programming, Steps followed in Program Development, Characteristics of good Program | 3,4 | 2 |
| | **1.2** | Overview of Programming Paradigms - Declarative and Imperative, Problem-solving using Algorithm and Flowcharts, | 3,4 | 2 |
| 2 | **Title** | **Basic Elements of Computer Programming and Control flow** | | |
| | **2.1** | Variables, keywords, Data types, Operators**:** Arithmetic, Relational and Logical, Assignment, Unary, Conditional, Bitwise, Expression, Statements. | 1,2 | 1 |
| | **2.2** | Branching Structures: if statement, if-else statement, multi-way decision, switch statement, continue statement, break statement Iterative Structures: while, do-while, for, nested loops | 1,2 | 3 |
| | **2.3** | Problem solving using Control Structures for real world problems | 1,2,4 | 2 |
| 3 | **Title** | **Problem Solving using Array Techniques** | | |
| | **3.1** | Introduction to Arrays: Declaration, Definition, accessing array elements, one-dimensional array, two-dimensional array, array of characters, Strings | 1,2 | 2 |
| | **3.2** | Classical Problem-Solving using Arrays like Array Order Reversal, Array Counting or Histogramming, Finding the maximum number in a set. | 1,2,4 | 2 |
| | **3.3** | Text Processing problems like finding length, keyword search, finding anagrams | 1,2,4 | 2 |
| 4 | **Title** | **Problem Solving using Modular Approach** | | |
| | **4.1** | Defining a Function, accessing a Function, Function Prototype, Passing Arguments to a Function, call by value, pointers and call by reference, Recursion | 1,2 | 4 |
| | **4.2** | Problem solving using Functions and Recursive applications | 1,2,4 | 3 |
| 5 | **Title** | **Structures and Unions** | | |
| | **5.1** | Structures and Union: Declaration, Initialization, structure within structure, Array of Structure, Operation on structures, Concept of Union, Difference between structure and union, | 1,2 | 3 |
| | **5.2** | Real world problems using Structures and Unions | 1,2,4 | 2 |
| 6 | **Self-Study** | File handling**:** Types of Files, File operation-opening, Closing, Creating, Reading, Processing File, Command line arguments, Dynamic Memory Allocation | 1,2,4 | **4*** |
| | | | **Total (* not counted in total hours)** | **28** |

**Laboratory Component (Minimum 10 Laboratory experiments are expected)**
**Note: All problems should be implemented using C language.**

| Sr. No. | Title of the Experiment |
|---|---|
| 1 | Use the formatted input/output statements, operators and expressions of C language |
| 2 | Apply various control structures to solve given problems. |
| 3 | Apply the concept of functions to incorporate modularity. |
| 4 | Demonstrate the use of one-dimensional arrays to solve a given problem. |
| 5 | Demonstrate the use of two-dimensional arrays to solve a given problem. |
| 6 | Apply the concept of recursion to solve a given problem. |
| 7 | Implement various text processing problems. |
| 8 | Apply the concepts of structures/union to solve a given problem. |
| 9 | Demonstrate the use of pointers to solve a given problem. |
| 10 | Implement various operations on files to solve a given problem. |

**Text Books**

| Sr. No. | Title | Edition | Authors | Publisher | Year |
|---|---|---|---|---|---|
| 1 | Programming with C | Fourth | Byron Gottfried | McGraw Hill (Schaum's outline series) | 2018 |
| 2 | The C programming Language | Second | Kernighan , Ritchie | Pearson | 2015 |
| 3 | Foundations of Programming Languages | Second | Kent D. Lee | Springer | 2017 |
| 4 | How to Solve it by Computer | First | R. G. Dromey | Prentice Hall India | 1998 |

**Reference Books**

| Sr. No | Title | Edition | Authors | Publisher | Year |
|---|---|---|---|---|---|
| 1 | Let Us C | Sixteenth | Yashavant Kanetkar | BPB | 2017 |
| 2 | Programming Language Concepts | Third | Carlo Ghezi, Mehdi Jazayeri | John Wiley & Sons | 2008 |
| 3 | Computer Programming in C | Second | V. Rajaraman & Neeharika Adabala | PHI Learning, Eastern Economy Edition, | 2014 |

# Department of Computer Engineering

| Course (Category) Code | Course Name | Teaching Scheme (Hrs/week) | | | | | Credits Assigned | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | L | T | P | O | E | L | T | P | Total |
| (ESC) | Digital Systems and Microprocessor | 3 | 0 | 2 | 5 | 10 | 3 | 0 | 1 | 4 |
| | | Examination Scheme | | | | | | | | |
| EC101 | | Component | ISE | | MSE | | ESE | | | Total |
| | | Theory | 75 | | 75 | | 150 | | | 300 |
| | | Laboratory | 50 | | -- | | 50 | | | 100 |

| | |
|---|---|
| **Pre-requisite Course Codes, if any.** | |
| **Course Objective:** To prepare students to perform the analysis and design of various digital electronic circuits and introduce them to the concept of microprocessors | |
| **Course Outcomes (CO): At *the End of the course students will be able to*** | |
| EC101.1 | Explain various logic gates, SOP, POS forms and their minimization with k- map for given combinational circuits. |
| EC101.2 | Construct combinational circuits using given MSI devices. |
| EC101.3 | Apply the knowledge of flip-flops and MSI to design sequential circuits |
| EC101.4 | Compare the logic families based on their characteristics |
| EC101.5 | Comprehend the architectural features of 8085 with basic assembly language programming |

**CO-PO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| EC101.1 | | | | | | | | | | | | |
| EC101.2 | | | | | | | | | | | | |
| EC101.3 | | | | | | | | | | | | |
| EC101.4 | | | | | | | | | | | | |
| EC101.5 | | | | | | | | | | | | |

**CO-PEO/PSO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)**

| | PEO1 | PEO2 | PEO3 | PEO4 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|
| EC101.1 | | | | | | | |
| EC101.2 | | | | | | | |
| EC101.3 | | | | | | | |
| EC101.4 | | | | | | | |
| EC101.5 | | | | | | | |

**BLOOM'S Levels Targeted (Pl. Tick appropriate)**

| Remember | Understand | Apply | Analyze | Evaluate | Create |
|---|---|---|---|---|---|

# Department of Computer Engineering

**Theory Component**

| Module No. | Unit No. | Topics | Ref. | Hrs. |
|---|---|---|---|---|
| 1 | **Title** | **Combinational Circuits** | | **11** |
| | **1.1** | **Logic Gates:** Basic gates, Universal gates, Sum of products and products of sum, minimization with Karnaugh Map (up to four variables), Quine McCluskey method and realization. | 1,4 | |
| | **1.2** | **Combinational Circuits using basic gates as well as MSI devices:** Half adder, Full adder, Half Subtractor, Full Subtractor, Multiplexer, Demultiplexer, Decoder, Comparator | 1,4 | |
| 2 | **Title** | **Sequential Circuits** | | **11** |
| | **2.1** | **Sequential Logic:** Latches and Flip-Flops. Conversions of Flip-Flops. | 1,4 | |
| | **2.2** | **Counters:** Asynchronous Counters, Synchronous Counters, Up Down Counters, Mod Counters, Ring and Twisted Ring Counters, Shift Registers, Universal Shift Register | 1,4 | |
| | **2.3** | MSI counters (IC 7490, IC 74160, IC 74163, IC 74169), MSI Shift registers (IC 74194) and their applications | 2,5 | |
| 3 | **Title** | **Clocked Synchronous Machines** | | **05** |
| | **3.1** | Mealy and Moore Machines, clocked synchronous state machine analysis, State reduction techniques. | 2,5 | |
| 4 | **Title** | **Logic Families** | | **05** |
| | **4.1** | Types of logic families (TTL and CMOS), characteristic parameters (propagation delays, power dissipation, Noise Margin, Fan-out and Fan-in), transfer characteristics of TTL NAND. | 1,4 | |
| 5 | **Title** | **Introduction to Microprocessors** | | **10** |
| | **5.1** | Evolution of computers and Microprocessors | 3 | |
| | **5.2** | Essential components of a conventional Central Processing Unit (CPU) | 3 | |
| | **5.3** | Architecture of 8-bit microprocessor 8085 | 3 | |
| | **5.4** | Basic instruction set with its addressing modes and concepts of Instruction cycle, Machine cycle and T states. Elementary programming in assembly language. | 3 | |
| | **5.5** | Elements of I/O data transfer with the concept of interrupts | 3 | |
| 6 | **Self-Study** | Concepts of PROM, PAL and PLA. Timing Considerations and Meta-stability in Flip-Flops. Clocked synchronous state machine design. Interfacing CMOS to TTL and TTL to CMOS. Concepts of peripherals and memory with its interfacing with 8085 microprocessors | | **5*** |
| | | | **Total (*Not included)** | **42** |

# Department of Computer Engineering

**Laboratory Component (Minimum 10 Laboratory experiments are expected)**

| Sr. No. | Title of the Experiment |
|---|---|
| **1** | To implement the combinational logic for given function using basic gates/MSI ICs.<br>a. To study and verify the truth table of logic gates<br>b. To study the universal NAND and NOR gate<br>c. To study the working of half adder, full adder, half subtractor, Full subtractor along with truth table |
| **2** | To implement TTL and CMOS logic family<br>a. To study TTL NAND gate (BJT implementation).<br>b. To study CMOS NAND gate<br>c. To study interfacing of the TTL /CMOS |
| **3** | To implement 4-bit, 5-bit and 8-bit comparator using given MSI |
| **4** | To design implement gate level multiplexers and MSI multiplexers |
| **5** | To design and implement gate level and MSI circuits of flip-flops |
| **6** | To design counters<br>a. To design a MOD4 synchronous up/down counter<br>b. To study IC 7490 – Asynchronous Decade Counter |
| **7** | To synchronous counters, synchronous counters and shift register using given MSI.<br>a. To study IC 74160 as Synchronous Decade Counter and Mod 6 counter<br>b. To study IC 74163 as Synchronous MOD 16 Counter and Mod 10 counter<br>c. To verify the truth table of IC 74194 as Universal Shift Register and implement Ring and Twisted Ring Counter. |
| 8 | To perform basic arithmetic operations through assembly language program in 8085 |
| 9 | To simulate COPY and PASTE operation through 8085 assembly program |
| 10 | To write a program to add N elements stored in an array of 8 bit numbers (8085) |

**Text Books**

| Sr. No. | Title | Edition | Authors | Publisher | Year |
|---|---|---|---|---|---|
| 1. | Modern Digital Electronics | Fourth | R. P. Jain | Tata McGraw Hill | 2009 |
| 2 | Digital Design Principles and Practices | Third | John F. Wakerly | Pearson Education | 2001 |
| 3 | Microprocessor Architecture, Programming, and Applications with the 8085 | Sixth | Ramesh S. Gaonkar | Penram International | 2013 |

**Reference Books**

| Sr. No. | Title | Edition | Authors | Publisher | Year |
|---|---|---|---|---|---|
| 1 | Digital Design | Forth | Morris Mano | Pearson Education | 2008 |
| 2 | Fundamentals of digital logic design with VHDL | Second | Stephen Brown and Zvonko Vranesic | McGraw Hill | 2006 |

# Department of Computer Engineering

| Course (Category) Code | Course Name | Teaching Scheme (Hrs/week) | | | | | Credits Assigned | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | L | T | P | O | E | L | T | P | Total |
| (SBC) | Communication Skills | 1 | 0 | 2 | 2 | 5 | 1 | 0 | 1 | 2 |
| | | Examination Scheme | | | | | | | | |
| | | Component | ISE | | MSE | | ESE | | Total | |
| AS107 | | Theory | -- | | 50** | | -- | | 50 | |
| | | Laboratory | 150* | | -- | | -- | | 150 | |

** MSE will be evaluated on the basis of written test based on module 1 and 2.
** ISE will be evaluated on the basis of marks scored in practicals, out of 150.

| Pre-requisite Course Codes, if any. | |
|---|---|
| **Course Objective:** To apply the principles of communication in personal and professional environment. | |
| **Course Outcomes (CO): At *the end of the course students will be able to*** | |
| AS107.1 | Apply the principles of business writing for professional documents. |
| AS107.2 | Develop advance vocabulary and grammar for spoken and written communication. |
| AS107.3 | Design the draft a formal speech. |
| AS107.4 | Analyze received information by using active listening and reading skills. |

**CO-PO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AS107.1 | | | | | | | | | | 2 | | |
| AS107.2 | | | | | | | | | | 2 | | |
| AS107.3 | | | | | | | | | | 2 | | |
| AS107.4 | | | | | | | | | | 2 | | |

**CO-PEO/PSO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)**

| | PEO1 | PEO2 | PEO3 | PEO4 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|
| AS107.1 | | | | | | | |
| AS107.2 | | | | | | | |
| AS107.3 | | | | | | | |
| AS107.4 | | | | | | | |

**BLOOM'S Levels Targeted (Pl. Tick appropriate)**

| Remember | Understand | Apply ✓ | Analyze ✓ | Evaluate | Create |
|---|---|---|---|---|---|

# Department of Computer Engineering

**Theory Component**

| Module No. | Unit No. | Topics | Ref. | L Hrs. | P Hrs |
|---|---|---|---|---|---|
| 1 | Title | **Vocabulary Building & Grammar** | | 2 | 4 |
| | 1.1 | Concept of word formation, the root words from foreign languages and their use in English | 7,1 | | |
| | 1.2 | Common errors in writing, confused pair of words, redundancies, clichés | 6, 2 | | |
| 2 | Title | **Writing Skills** | | 7 | 14 |
| | 2.1 | Principles of Business Writing: 7Cs of communication, sentence structures, Organizing paragraph in direct and indirect style; Summarization | 4 | | |
| | 2.2 | Practices in Writing: E-mail Etiquettes, e-mail for business purposes | 3 | | |
| | 2.3 | Critical Reading: understanding the concept of critical reading and applying to analyze a given text. | 5 | | |
| 3 | Title | **Oral Skills** | | 5 | 10 |
| | 3.1 | Listening Comprehension(audio): Pronunciation, intonation, Stress and Rhythm | 5 | | |
| | 3.2 | Speaking Practices:<br>1. Common everyday situation: Conversation and dialogues (group activity, ice-breaking session)<br>2. Public Speaking: Extempore, formal speech | 3 | | |
| 4 | Self-Study | 1. Basic Rules of Grammar<br>2. GRE Vocabulary<br>3. Reading a book(fiction/non-fiction) and preparing a review on it | | 6* | |
| | | | **Total (*Not included)** | **42 hrs** | |

**List of activities (Graded, Non-graded)**

| Sr. No. | Title of the assignments | Marks |
|---|---|---|
| 1 | Skit based on a given situation | - |
| 2 | ISE 1 – Summary Writing | 10 |
| 3 | ISE 2 – Extempore | 10 |
| 4 | ISE 3 – Grammar | 20 |
| 5 | ISE 4 – Vocabulary | 20 |
| 6 | Reviewing a book (fiction/ non-fiction) | 10 |
| 7 | ISE 5 – Email Writing (Inquiry) | 20 |
| 8 | ISE 6 – Email Writing (Complaint) | 20 |
| 9 | ISE 6 – Speech | 20 |
| 10 | ISE 7 – Critical Reading | 20 |
| | **Total** | **150** |

**Text Books:**

| Sr. No. | Title | Edition | Authors | Publisher | Year |
|---|---|---|---|---|---|
| 1 | Communication Skills | 2013 | Shirley Mathews | Technical Publication, Pune | 2013 |
| 2 | English Vocabulary in Use | 1999 | Michael McCarthy , Felicity O'Dell | Cambridge University Press, India | 1999 |

**Reference Books:**

| Sr. No. | Title | Edition | Authors | Publisher | Year |
|---|---|---|---|---|---|
| 1 | Oxford Practice Grammar | 1999 | John Eastwood | Oxford, India | 1999 |
| 2 | Communication Skills | 2011 | Meenakshi Raman, Sangeeta Sharma | Oxford, India | 2011 |
| 3 | Communication Skills | 2010 | Dr. Meera Bharwani | Synergy Knowledge ware, India | 2010 |
| 4 | English Grammar for Today | 2005 | Geoffrey Leech | Palgrave, UK | 2005 |
| 5 | Word Power Made Easy | 1978 | Norman Lewis | Anchor Books, New York | 1978 |

## Department of Computer Engineering

# Semester-II

# Department of Computer Engineering

| Course (Category) Code | Course Name | Teaching Scheme (Hrs/week) | | | | | Credits Assigned | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | L | T | P | O | E | L | T | P | Total |
| (BSC) | Differential Equations and Complex Analysis | 3 | 1 | 0 | 8 | 12 | 3 | 1 | 0 | 4 |
| | | Examination Scheme | | | | | | | | |
| | | Component | ISE | | MSE | | ESE | | Total | |
| MA102 | | Theory | 75 | | 75 | | 150 | | 400 | |
| | | Laboratory | -- | | -- | | -- | | -- | |

| | |
|---|---|
| **Pre-requisite Course Codes, if any.** | MA101 |
| **Course Objective:** To develop mathematical skills for solving engineering problems. | |
| **Course Outcomes (CO): At *the End of the course students will be able to:-*** | |
| MA102.1 | Solve differential equations of first order. |
| MA102.2 | Solve differential equations of higher order using operators. |
| MA102.3 | Solve differential equations in electrical engineering problems. |
| MA102.4 | Find powers, roots & logarithm of a complex number and to separate the function of a complex number into real and imaginary. |
| MA102.5 | Check whether a given function is analytic and construct analytic functions. |
| MA102.6 | Compute integrals of complex valued functions. |

**CO-PO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MA102.1 | 3 | | | | | | | | | | | |
| MA102.2 | 3 | | | | | | | | | | | |
| MA102.3 | 1 | 1 | | | | | | | | | | |
| MA102.4 | 3 | | | | | | | | | | | |
| MA102.5 | 2 | | | | | | | | | | | |
| MA102.6 | 2 | 1 | | | | | | | | | | |

**CO-PEO/PSO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)**

| | PEO1 | PEO2 | PEO3 | PEO4 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|
| MA102.1 | | | | | | | |
| MA102.2 | | | | | | | |
| MA102.3 | | | | | | | |
| MA102.4 | | | | | | | |
| MA102.5 | | | | | | | |
| MA102.6 | | | | | | | |

**BLOOM'S Levels Targeted (Pl. Tick appropriate)**

| | | | | | |
|---|---|---|---|---|---|
| Remember ✔ | Understand ✔ | Apply ✔ | Analyze | Evaluate | Create |

# Department of Computer Engineering

**Theory Component**

| Module No. | Unit No. | Topics | Ref | Hrs. |
|---|---|---|---|---|
| 1 | **Title** | **Linear Differential Equations of first order** | 1,2,3 | 11 |
| | **1.1** | Exact Differential Equations, Integrating Factors, equations reducible to exact form. | | 3 |
| | **1.2** | Linear differential equations (Definition), equations reducible to linear form, Bernoulli's equation | | 2 |
| | **1.3** | Simple application of differential equation of first and second order to electrical engineering problems. | | 2 |
| | **1.4** | Numerical solution of ordinary differential equations of first order and first degree using<br>a) Taylor's series method<br>b) Euler's method<br>c) Modified Euler method<br>d) Runge-Kutta fourth order formula. | | 4 |
| 2 | **Title** | **Linear Differential Equations of higher order** | 1,2,3 | **11** |
| | **2.1** | Linear Differential Equation with constant coefficient-complementary function, particular integrals of differential equation of the type f(D)y = X where X is $e^{ax}$, sin(ax+b), cos(ax+b), $x^m$, $e^{ax}$V, xV, where V is a function of x. | | 7 |
| | **2.2** | Cauchy's homogeneous linear differential equation and Method of variation of parameters for second order. | | 2 |
| | **2.3** | System of Differential Equations. | | 2 |
| 3 | **Title** | **Complex Numbers** | 1,2,3 | **12** |
| | **3.1** | **Revision:** Complex Numbers as ordered pairs, Argand's diagram, Cartesian, Polar and Exponential form of Complex Numbers. | | 1 |
| | **3.2** | De Moivre's Theorem and its application to determine powers of complex numbers. Roots of complex numbers by De Moivre's Theorem. | | 3 |
| | **3.3** | Expansion of $\sin n\theta$ and $\cos n\theta$ in terms of powers of $\sin\theta$ and $\cos\theta$. Expansion of $sin^n\theta$ and $cos^n\theta$ in terms of sines and cosines of multiples of $\theta$. | | 2 |
| | **3.4** | Hyperbolic Functions: relation between circular and hyperbolic functions, Inverse hyperbolic functions. Separation into real and imaginary parts of complex functions. | | 4 |
| | **3.5** | Logarithm of a complex number. | | 2 |
| 4 | **Title** | **Analytic functions and Complex Integrals** | 1,2,3 | **8** |
| | **4.1** | Analytic functions, Cauchy Reimann equations in cartesian and polar form, construction of analytic functions using Milne-Thompson's method, Harmonic functions, poles of f(z). | | 4 |
| | **4.2** | Line Integral, Cauchy's Integral theorem for simply connected regions, Cauchy's Integral formula (for poles lying inside or outside the curve). | | 4 |

| | | | | |
|---|---|---|---|---|
| **5** | **Self-Study** | 1.3 To form D.E. for given L-C-E-R circuit<br>1.4 Picard's method<br>2.1 Method of undetermined coefficients to solve differential equations.<br>2.2 Legendre's differential equation, Method of variation of parameters for third order differential equations.<br>3.2 Complex examples using De Moivre's Theorem.<br>4.1 Construction of analytic function f(z) =u+iv when u+v or u-v is given. Orthogonal trajectories | | **08** |
| | | | **Total** | **42*** |

***Total of 42 hours does not include self-study hours.**

**Text Books**

| Sr. No. | Title | Edition | Authors | Publisher | Year |
|---|---|---|---|---|---|
| 1. | Higher Engineering Mathematics | Forty Fourth | Dr. B. S. Grewal | Khanna Publications | 2020 |

**Reference Books**

| Sr. No. | Title | Edition | Authors | Publisher | Year |
|---|---|---|---|---|---|
| 1. | Advanced Engineering Mathematics | Twenty Eighth | H. K Das | S. Chand | 2014 |
| 2. | Advanced Engineering Mathematics | Tenth | Erwin Kreysizg | John Wiley & Sons | 2011 |
| 3. | Advanced Engineering Mathematic | Fourth | Jain and Iyengar | Narosa Publications | 2014 |

# Department of Computer Engineering

| Course (Category) Code | Course Name | Teaching Scheme (Hrs/week) | | | | | Credits Assigned | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | L | T | P | O | E | L | T | P | Total |
| BSC | Engineering Physics | 2 | 1 | 2 | 5 | 10 | 2 | 1 | 1 | 4 |
| | | Examination Scheme | | | | | | | | |
| | | Component | ISE | | MSE | | ESE | | | Total |
| AS101 | | Theory | 75 | | 75 | | 150 | | | 300 |
| | | Laboratory | 50 | | -- | | 50 | | | 100 |

| | |
|---|---|
| **Pre-requisite Course Codes, if any.** | HSC level physics |
| **Course Objective:** To provide the knowledge and methodology necessary for solving problems in the field of engineering | |
| **Course Outcomes (CO): At *the End of the course students will be able to*** | |
| AS101.1 | Illustrate the knowledge of basic concepts of semiconductor physics, lasers and quantum mechanics. |
| AS101.2 | Solve the problems by applying the basics concepts of physics. |
| AS101.3 | Use the Schrodinger equation to realize the concept of discreteness and quantum tunneling. |
| AS101.4 | Explain the working of various LASERs and its practical applications. |
| AS101.5 | To develop experimental skills and the practical abilities. |
| AS101.6 | To develop an ability of understanding of concepts and principles of physics. |
| AS101.7 | To comprehend importance of precision, accuracy of the experimental data. |

**CO-PO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AS101.1 | 1 | | | | | | | | | | | |
| AS101.2 | | 1 | | | | | | | | | | |
| AS101.3 | | 1 | | | | | | | | | | |
| AS101.4 | 1 | | | | | | | | | | | |
| AS101.5 | | | | 1 | | | | | | | | |
| AS101.6 | | | | 1 | | | | | | | | |
| AS101.7 | | | | | | | | | | | | |

**CO-PEO/PSO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)**

| | PEO1 | PEO2 | PEO3 | PEO4 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|
| AS101.1 | | | | | | | |
| AS101.2 | | | | | | | |
| AS101.3 | | | | | | | |
| AS101.4 | | | | | | | |
| AS101.5 | | | | | | | |
| AS101.6 | | | | | | | |
| AS101.7 | | | | | | | |

# Department of Computer Engineering

**BLOOM'S Levels Targeted (Pl. Tick appropriate)**

| Remember | Understand | Apply | Analyze | Evaluate | Create |
|---|---|---|---|---|---|

**Theory Component**

| Module No. | Unit No. | Topics | Ref. | Hrs. |
|---|---|---|---|---|
| **1** | **Title** | **Quantum Mechanics** | | **09** |
| | **1.1** | de-Broglie hypothesis; experimental verification of de Broglie hypothesis; wave packet, group velocity and phase velocity; Wave function, Physical interpretation of wave function; Heisenberg's uncertainty principle; Electron diffraction experiment; Applications of uncertainty principle | 1,2,3 | |
| | **1.2** | Schrodinger's time dependent wave equation, time independent wave equation; Application of time-independent Schrodinger equation - Particle trapped in one dimensional box and Potential barrier (Tunnelling), Harmonic oscillator (qualitative) | 1,2,3 | |
| **2** | **Title** | **Physics of Semiconductors and Semiconductor devices** | | **13** |
| | **2.1** | Conduction in metals and semiconductors; Fermi-Dirac distribution function and Fermi level in a conductor, insulator and semiconductor | 5 | |
| | **2.2** | Intrinsic and extrinsic semiconductors; intrinsic conductivity and extrinsic conductivity; Law of mass action, charge neutrality condition; intrinsic carrier concentration, electron and hole concentration; Extrinsic carrier concentration as a function of temperature; Effect of impurity concentration and temperature on the Fermi Level; Hall Effect and its applications. Drift and Diffusion current density | 5 | |
| | **2.3** | Formation of a P-N junction, depletion region and barrier potential; Energy band structure of P-N Junction (unbiased, forward-bias, reverse-bias); concept of carrier current densities in p-n junction in equilibrium, forward bias and reverse bias; Breakdown mechanism - Zener effect and avalanche | 5,6 | |
| | **1.4** | P-N junction devices: LED, Zener diode, photoconductors, photovoltaic solar cells and Bipolar Junction Transistors | 5,6 | |
| **3** | **Title** | **LASERS** | | **06** |
| | **3.1** | Processes - Absorption of light, spontaneous emission, stimulated emission; Einstein's equations, Population inversion; metastable states; pumping and pumping schemes; optical resonance cavity | 3,4 | |
| | **3.2** | Ruby and Helium Neon laser, semiconductor laser; Applications of laser in industry, medicine and holography. (construction & reconstruction of holograms) | 3,4 | |

| | | | | |
|---|---|---|---|---|
| **4** | **Self Study** | Interference of light in thin films having uniform thickness, Newton's rings, Applications of interference in anti-reflecting and highly reflecting thin films.<br>Diffraction of light, Diffraction due to single slit, double slit and diffraction grating. | | **05*** |
| | | | **Total (*Not included)** | **28** |

**Laboratory Component**

| Sr. No. | Title of the Experiment* |
|---|---|
| 1 | Determination of energy band gap of a semiconductor |
| 2 | Study of I-V characteristics of a Zener diode |
| 3 | Determination of the type of semiconductor sample, concentration of charge carriers and its mobility using Hall Effect |
| 4 | Determination of Planck's constant using photo vacuum tube |
| 5 | Measurement of ultrasonic velocity in liquid medium using ultrasonic interferometer |
| 6 | Determination of radius of curvature using Newton's Rings |
| 7 | Determination of thickness of a thin foil or wire using the interference pattern of a wedge-shaped film |
| 8 | Determination of wavelengths of a mercury source and resolving power of a plane diffraction grating |
| 9 | Study of single slit diffraction |
| 10 | Determination of grating element of a diffraction grating using a laser source |
| 11 | Determination of the numerical aperture of an optical fibre |
| 12 | Uses of a Cathode-Ray Oscilloscope |

*Students will perform any 10 of the above experiments

**Text Books**

| Sr. No. | Title | Edition | Authors | Publisher | Year |
|---|---|---|---|---|---|
| 1 | A Textbook of Engineering Physics | Eleventh | Dr. M. N. Avadhanulu & Dr. P. G. Kshirsagar | S. Chand | 2018 |
| 2 | Engineering Physics | First | D. K. Bhttacharya & Poonam Tandon | Oxford University Press | 2015 |

**Reference Books**

| Sr. No. | Title | Edition | Authors | Publisher | Year |
|---|---|---|---|---|---|
| 1 | Concepts of Modern Physics | Sixth | Arthur Beiser | McGraw Hill Education | 2009 |
| 2 | Modern Physics | Third | Serway, Moses and Moyer | Thomson Learning | 2005 |
| 3 | Fundamentals of Physics | Tenth | Halliday and Resnick | Wiley | 2013 |
| 4 | Solid State Physics | Eighth | S. O. Pillai | New Age International Publishers | 2018 |
| 5 | Solid State Electronic Devices | Seventh | Ben G. Streetman and Sanjay Kumar Banerjee | Pearson Education | 2016 |
| 6 | Lasers: Fundamentals and Applications | Second | Ghatak and Thyagarajan | Springer | 2011 |

# Department of Computer Engineering

| Course (Category) Code | Course Name | Teaching Scheme (Hrs/week) | | | | | Credits Assigned | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | L | T | P | O | E | L | T | P | Total |
| (ESC) | Engineering Graphics | 1 | 0 | 2 | 2 | 5 | 1 | 0 | 1 | 2 |
| | | Examination Scheme | | | | | | | | |
| | | Component | | ISE | | MSE | | ESE | | Total |
| AS104 | | Theory | | 20 | | 20 | | 60 | | 100 |
| | | Laboratory | | 60 | | -- | | 40 | | 100 |

| | |
|---|---|
| **Pre-requisite Course Codes, if any.** | Fundamentals up to 12th science |
| **Course Objective: To develop technical drawing and visualization skills using instrumental drawing and soft tool, required for design and modeling, in Engineering Applications and Solutions.** | |
| **Course Outcomes (CO):** ***At the End of the course students will be able to*** | |
| AS104.1 | Construct basic engineering curves. |
| AS104.2 | Draw projections of points and lines. |
| AS104.3 | Draw projections of regular solids inclined to both the reference planes. |
| AS104.4 | Read the 3-dimensional view and draw the orthographic projections. |
| AS104.5 | Read the 3-dimensional view and draw the sectional orthographic projections. |
| AS104.6 | Read the orthographic projections and draw isometric view. |

**CO-PO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AS104.1 | 3 | 3 | | | | | | | | | | 3 |
| AS104.2 | 3 | 3 | | | | | | | | | | 3 |
| AS104.3 | 3 | 3 | | | | | | | | | | 3 |
| AS104.4 | 3 | 3 | | | | | | | | | | 3 |
| AS104.5 | 3 | 3 | | | | | | | | | | 3 |
| AS104.6 | 3 | 3 | | | | | | | | | | 3 |

**BLOOM'S Levels Targeted (Pl. Tick appropriate)**

| Remember | Understand | Apply√ | Analyze | Evaluate | Create |
|---|---|---|---|---|---|
| | | | | | |

**Theory Component**

| Module No. | Unit No. | Topics | Ref. | Hrs. |
|---|---|---|---|---|
| 1 | Unit1 | **Introduction to Engineering Drawing** | 1,2 | 4 |
| | 1.1 | Introduction to Drawing Instruments, Types of Lines, Dimensioning Systems and Scaling as per IS conventions. First angle method of projection only | | |
| | 1.2 | Basic construction of Cycloid and Involutes. | | |

| | | | | |
|---|---|---|---|---|
| **2** | **Unit2** | **Projections of Points and Lines** | 1 | **4** |
| | **2.1** | Projection of points in all four quadrants | | |
| | **2.2** | Projection of lines parallel to one principal reference plane. | | |
| | **2.3** | Lines inclined to both the Reference Planes (Excluding Traces of lines). | | |
| **3** | **Unit3** | **Projections of solids** (Regular solids like Prism, Pyramid, Cylinder, Tetrahedron, Hexahedron and Cone only) | 1,2 | **7** |
| | **3.1** | Projection of solid resting on plane (Single step projection) | | |
| | **3.2** | Projection of solid such that base inclined to one reference plane (Two step projection) | | |
| | **3.3** | Projection of solid such that base inclined to both reference planes (Three step projection/problem)<br>(Exclude Spheres, Composite, Hollow solids and frustum of solids) | | |
| **4** | **Unit4** | **Orthographic Projections** | 1,2 | **Lab Sessions** |
| | **4.1** | Orthographic views of a simple machine part as per the first angle method of projection recommended by I.S. | | |
| | **4.2** | Full Sectional views of the Simple Machine parts. | | |
| **5** | **Unit5** | **Isometric Projections and views** | 2 | **Lab Sessions** |
| | **5.1** | Isometric views (Natural scale only) | | |
| **6** | **Self-Study** | 1.2 Construction of Engineering curves like ellipse, parabola, hyperbola, helix, other types of cycloids etc. by using different method of construction.<br>2.1 Projection of lines with traces, application-based problems on Projection of lines<br>3.1 Projections of cut solids with different cutting planes.<br>4.1 Solve more practice examples of orthographic views. Draw different views of a machine part/any object using third angle method of projection. (Axonometric view, oblique view, perspective etc.)<br>4.2 Half sectional orthographic views.<br>5.1 Development of surfaces of frustum of solid, and retaining part of the solid after cutting plane, reverse development of solid. | 1,2,3 | **6*** |
| | | | **Total (*Not included)** | **15** |

# Department of Computer Engineering

**Laboratory Component (Minimum 5 sheets are expected)**

| Sr. No. | Noof Sessions | Engineering AutoCAD Laboratory |
|---|---|---|
| 1 | **2** | Introduction to Auto-CAD: -Basic Draw and Modify Commands. Knowledge of setting up layers, Dimensioning, Hatching, plotting, and Printing. **Auto-Cad Practice sheet-1** |
| 2 | **1** | **Auto-Cad Practice sheet-2** |
| 3 | **2** | **Introduction to Orthographic projections sheet-3** |
| 4 | **2** | **Orthographic projections sheet-4** |
| 5 | **2** | **Introduction to Sectional Orthographic projections sheet-5** |
| 6 | **2** | **Sectional Orthographic projections sheet-6** |
| 7 | **2** | **Introduction to Isometric Projection/View: -** Isometric View of blocks with plain and cylindrical surfaces is using plain/natural scale only. (Exclude Spherical surfaces). **Isometric Projection/View sheet-7** |
| 8 | **2** | **Isometric Projection/View sheet-8** |
| **Total** | **15** | |

**Text Books:**

| Sr. No | Title | Edition | Authors | Publisher | Year |
|---|---|---|---|---|---|
| 1 | Engineering Drawing | 53rd | N D Bhatt | Charotar | 2016 |
| 2 | Engineering Drawing | 3rd | Dhananjay A Jolhe | Tata McGraw Hill | 2011 |

**Reference Books**

| Sr. No | Title | Edition | Authors | Publisher | Year |
|---|---|---|---|---|---|
| 1 | AutoCAD 2017 | -- | Sham Tickoo | Dream Tech Press, Delhi | 2017 |
| 2 | Engineering Drawing and Graphics | Fifth | K Venugopal | New Age International | 2011 |

# Department of Computer Engineering

| Course (Category) Code | Course Name | Teaching Scheme (Hrs/week) | | | | | Credits Assigned | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | L | T | P | O | E | L | T | P | Total |
| (ESC) | Basic Electrical Engineering | 3 | 0 | 2 | 6 | 11 | 3 | 0 | 1 | 4 |
| | | Examination Scheme | | | | | | | | |
| ET101 | | Component | ISE | | MSE | | ESE | | Total | |
| | | Theory | 75 | | 75 | | 150 | | 300 | |
| | | Laboratory | 50 | | -- | | 50 | | 100 | |

| | |
|---|---|
| **Pre-requisite Course Codes, if any.** | Basic concepts of electric charge, current, voltage and Power |
| **Course Objective:** To impart a basic knowledge of electrical quantities, Circuits and components. | |
| **Course Outcomes (CO):** ***At the End of the course students will be able to*** | |
| ET101.1 | Compute various electrical quantities of given dc circuit using circuit simplification techniques and various network theorems. |
| ET101.2 | To expose the students to different terms and concepts in AC Circuits at fundamental frequency and to expose them to basics of effects of harmonics in the waveforms |
| ET101.3 | To study the working principles of electrical machines and their applications |
| ET101.4 | To expose the students the fundamental concepts in Controllable Switch and Modulation based Power Conversion |
| ET101.5 | To study Electrical Parameters of the Batteries and their selection and design criteria for a specific application |

**CO-PO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ET101.1 | | | | | | | | | | | | |
| ET101.2 | | | | | | | | | | | | |
| ET101.3 | | | | | | | | | | | | |
| ET101.4 | | | | | | | | | | | | |
| ET101.5 | | | | | | | | | | | | |

**CO-PEO/PSO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)**

| | PEO1 | PEO2 | PEO3 | PEO4 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|
| ET101.1 | | | | | | | |
| ET101.2 | | | | | | | |
| ET101.3 | | | | | | | |
| ET101.4 | | | | | | | |
| ET101.5 | | | | | | | |

**BLOOM'S Levels Targeted (Pl. Tick appropriate)**

| Remember | Understand | Apply | Analyze | Evaluate | Create |
|---|---|---|---|---|---|

# Department of Computer Engineering

**Theory Component**

| Module No. | Unit No. | Topics | Ref. | Hrs |
|---|---|---|---|---|
| 1 | **Title** | **DC Circuits** | 1,2 | **10** |
| | **1.1** | Electrical circuit elements (R, L and C), Voltage and current sources, Equivalent resistance of circuits, Simplification using delta-star and star-delta transformation. | | |
| | **1.2** | Kirchoff's current and voltage laws, Analysis of simple circuits with dc excitation. Mesh analysis, Superposition, Thevenin, Norton and Maximum Power Transfer Theorems | | |
| | **1.3** | Time-domain analysis of first-order DC Transients in RL and RC circuits. | | |
| 2 | **Title** | **AC Circuits** | 1,2 | **12** |
| | **2.1** | Representation of sinusoidal waveforms, peak and rms values, phasor representation, real power, reactive power, apparent power, power factor. Harmonics, Total Harmonic Distortion, Power supplied by Harmonic voltages and currents, Power factor in case of non-sinusoidal waveforms. | | |
| | **2.2** | AC Analysis of series and parallel RLC Circuits with Resonance, Concept of Bandwidth and Q-factor, | | |
| | **2.3.** | Three-phase balanced circuits, voltage and current relations in star and delta connections. | | |
| 3 | **Title** | **Electromagnetic and Electro-Mechanical Energy Converters** | 1,2 | **10** |
| | **3.1** | Magnetically Coupled Coils, Self and Mutual Inductance and Dot Convention | | |
| | **3.1** | Single Phase Transformer: Principle of Operation, Equivalent Circuits | | |
| | **3.2** | Single Phase Transformer: Efficiency and Regulation | | |
| | **3.3** | Introduction to Three-phase Transformers and Applications | | |
| | **3.4** | Fundamental Principles of Rotating Machines, Characteristics of Induction motor and DC motor | | |
| 4 | **Title** | **Electric Power Converters** | 1,2 | **05** |
| | **4.1** | Fundamental Principles of Buck, Boost and buck-boost DC-DC converters and their Transfer Characteristics, Duty Ratio Control | | |
| | **4.2** | Single-phase voltage source inverters and PWM | | |
| 5 | **Title** | **Batteries: Electrical Characteristics and Applications** | | **05** |
| | **5.1** | Introduction to type of Batteries, Generalized Battery parameters such as SoC, DoD, Energy and Power Densities, Battery C-rating, etc. Comparison of Batteries, Charging and Discharging Characteristic | | |
| | **5.2** | Selection and Sizing of Battery Packs for Specific Applications | | |

| | | | | |
|---|---|---|---|---|
| **6** | **Self-Study** | Components of LT Switchgear: Switch Fuse Unit (SFU), MCB, ELCB, MCCB, Types of Wires and Cables, Earthing. Elementary calculations for energy consumption and power factor improvement. | | **6*** |
| | | | **Total (*Not Included)** | **42** |

**Laboratory Component (Minimum 10 Laboratory experiments are expected)**

| Sr. No. | Title of the Experiment |
|---|---|
| 01 | Introduction to Electrical Measuring instruments, Lamp Loads, Inductor Loads and Capacitor Bank |
| 02 | Verification of Star-Delta and Delta-star Transformation with Kirchhoff's Laws |
| 03 | Verification of Thevenin's Norton's and Maximum Power Transfer Theorem |
| 04 | Verification of DC Transient equations in RL and RC Circuits |
| 05 | Experimental study of single-phase AC circuit with R-L and R-C Load with Measurement of Power and Power factor |
| 06 | Experimental study of R-L-C series Resonance. To plot resonance curve, To compute Bandwidth and Q-factor |
| 07 | Experiment on Magnetic Circuit Fundamentals |
| 08 | Loading of a transformer: measurement of primary and secondary voltages and currents, and power. To compute efficiency and regulation. |
| 09 | Three-phase transformers: Star and Delta connections. Voltage and Current relationships (line-line voltage, phase-to-neutral voltage, line and phase currents). Phase-shifts between the primary and secondary side. Cumulative three-phase power in balanced three-phase circuits. |
| 10 | Synchronous speed of two and four-pole, three-phase induction motors. Direction reversal by change of phase-sequence of connections. Torque-Slip Characteristic of an induction motor. Generator operation of an induction machine driven at super-synchronous speed. |
| 11 | Demonstration of (a) dc-dc converters (b) dc-ac converters – PWM waveform. |
| 12 | Demonstration of V/F control of Induction motor |
| 13 | Experimental study of charge and Discharge characteristics of a Lead-acid Battery |
| 14 | Introduction to L.T. Switch gear |

**Text Books**

| Sr. No. | Title | Edition | Authors | Publisher | Year |
|---|---|---|---|---|---|
| 1 | Basic Electrical Engineering | Third | D. P. Kothari and I. J. | Tata McGraw Hill | 2010 |
| 2 | Electrical Technology | Twenty Third | B. L. Theraja | S. Chand Publications | 2003 |

**Reference Books**

## Department of Computer Engineering

| Sr. No. | Title | Edition | Author | Publisher | Year |
|---|---|---|---|---|---|
| 1 | Basic Electrical Engineering | Second | D. C. Kulshreshtha | McGraw Hill | 2019 |
| 2 | Fundamentals of Electrical Engineering | Second | L. S. Bobrow | Oxford University Press | 2011 |
| 3 | Electrical and Electronics Technology | Third | E. Hughes | Pearson | 2010 |
| 4 | Electrical Engineering Fundamentals | Second | V. D. Toro | Prentice Hall India | 1989 |
| 5 | Elements of Power Electronics | Second | P. T. Krein | Oxford University Press | 2015 |
| 6 | Power Electronics: Converters, Application and Design | Second | Ned Mohan, T.M Undelands and W P Robbins | John Wiley and Sons. Inc. | 1995 |
| 7 | Electric Machinery | Sixth | A. E. Fitzgerald, C. Kingsley and S. D. Umans | McGraw-Hill | 2003 |

# Department of Computer Engineering

| Course (Category) Code | Course Name | Teaching Scheme (Hrs/week) | | | | | Credits Assigned | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | L | T | P | O | E | L | T | P | Total |
| (ESC) | Problem Solving using OOP | 2 | 0 | 4 | 4 | 10 | 2 | 0 | 2 | 4 |
| | | Examination Scheme | | | | | | | | |
| CE102 | | Component | ISE | | MSE | | ESE | | | Total |
| | | Theory | -- | | -- | | -- | | | -- |
| | | Laboratory | 300 | | -- | | 100 | | | 400 |

| | |
|---|---|
| **Pre-requisite Course Codes, if any.** | Problem Solving using Imperative Programming |
| **Course Objective:** To learn problem solving using Object-Oriented programming paradigm | |
| **Course Outcomes (CO):** ***At the End of the course students will be able to*** | |
| CE102.1 | Apply concepts of object-oriented programming using classes and objects |
| CE102.2 | Apply Inheritance for a given scenario |
| CE102.3 | Apply polymorphism for solving a given problem |
| CE102.4 | Apply abstraction and exception handling to create efficient program. |

**CO-PO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CE102.1 | 2 | 2 | 2 | | | | | | | | | |
| CE102.2 | 2 | 2 | 2 | | | | | | | | | |
| CE102.3 | 2 | 2 | 2 | | | | | | | | | |
| CE102.4 | 2 | 2 | 2 | | | | | | | | | |

**CO-PEO/PSO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)**

| | PEO1 | PEO2 | PEO3 | PEO4 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|
| CE102.1 | 2 | | | | | | |
| CE102.2 | 2 | | | | | | |
| CE102.3 | 2 | | | | | | |
| CE102.4 | 2 | | | | | | |

**BLOOM'S Levels Targeted (Pl. Tick appropriate)**

| Remember | Understand | Apply✔ | Analyze | Evaluate | Create |
|---|---|---|---|---|---|
| | | | | | |

# Department of Computer Engineering

**Theory (This course content delivery will be in C++/Java. Course Contents to be taken care accordingly)**

| Module No. | Unit No. | Topics | Ref. | Hrs. |
|---|---|---|---|---|
| 1 | | **Introduction and Encapsulation** | | 8 |
| | 1.1 | Introduction to Object Oriented Programming, Procedural verses Object Oriented Programming, Principles, Benefits and applications of Object-Oriented Programming. | 1,2 | |
| | 1.2 | Encapsulation: Problem solving with Objects and Classes | | |
| | 1.3 | static data member and methods, constructors and their types. Types of functions and keywords, Strings, Arrays | | |
| 2 | | **Inheritance** | | 6 |
| | 2.1 | Concept of Inheritance, parent class, derived class, base class and derived class constructor | 1,2 | |
| | 2.2 | Types of inheritance: single, multiple, multilevel, hierarchical, hybrid | | |
| | 2.3 | Aggregation and Composition | | |
| 3 | | **Polymorphism** | | 6 |
| | 3.1 | Static Polymorphism: Method overloading and Constructor overloading | 1,2 | |
| | 3.2 | Dynamic Polymorphism: Method overriding | | |
| | 3.3 | Data conversion | | |
| 4 | | **Abstraction** | | 2 |
| | 4.1 | Abstraction: abstract class | 1,2 | |
| 5 | | **Exception Handling** | | 6 |
| | 5.1 | try, throw, and catch exceptions | 1,2 | |
| | 5.2 | Function exception declaration | | |
| 6 | Self Study | File Handling,<br>$ STL, $pointers, $virtual functions<br>@Multithreading, @Packages, @interface | 1,2 | 5* |
| **Total** | | | | 28+ 5* |

**$ only for C++**
**@ only for Java**

**** Language used: C++ for Etrx and Extc Branch**
**** Language used: C++/Java for IT and CE Branch**

**Laboratory Component**

| Sr. No. | Title of the Experiment |
|---|---|
| 1 | Program on Encapsulation: Write a program to demonstrate classes and objects |
| 2 | Program on Encapsulation: Write a program to demonstrate constructor |
| 3 | Program on Polymorphism: Implement a Program to demonstrate method overloading, |
| 4 | Program on Polymorphism: Implement a Program to demonstrate constructor overloading |
| 5 | Program on Polymorphism: Implement a Program to demonstrate method overriding |
| 6 | Program on Inheritance: Implement a Program to demonstrate single, multilevel Inheritance |
| 7 | Program on Inheritance: Implement a Program to demonstrate multiple Inheritance |
| 8 | Program on Abstraction: Implement a Program to demonstrate Abstraction using abstract class |
| 9 | Program on Abstraction: Implement a Program to demonstrate multithreading/ STL |
| 10 | Program to demonstrate File Handling |

**Text Books**

| Sr. No. | Title | Edition | Authors | Publisher | Year |
|---|---|---|---|---|---|
| **1** | Object Oriented Programming with C++ | Sixth | E Balagurusamy | Tata McGraw Hill | 2017 |
| **2** | Oriented Programming in Turbo C++ | Fourth | Robert Lafore | Galgotia | 2001 |
| **3** | Java -The Complete Reference | Tenth | Herbert Schildt | Tata McGraw-Hill | 2017 |
| **4** | Java Programming From the Ground Up | First | Ralph Bravaco, Shai Simoson | Tata McGraw-Hill | 2009 |

**Reference Books**

| Sr. No. | Title | Edition | Authors | Publisher | Year |
|---|---|---|---|---|---|
| **1** | The Compete Reference C++ | Fourth | Herbert Schlitz | Tata McGraw Hill | 2017 |
| **2** | An introduction to Programming and Object Oriented Design using Java | Third | Jaime Nino, Frederick A. Hosch | Wiley Student Edition | 2010 |

# Department of Computer Engineering

| Course (Category) Code | Course Name | Teaching Scheme (Hrs/week) | | | | | Credits Assigned | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | L | T | P | O | E | L | T | P | Total |
| (SBC) | Skill Shop | 0 | 0 | 2 | 0 | 02 | 0 | 0 | 1 | 1 |
| | | Examination Scheme | | | | | | | | |
| AS106 | | Component | ISE | | MSE | | ESE | | Total | |
| | | Theory | -- | | -- | | -- | | -- | |
| | | Laboratory | 50 | | -- | | 50 | | 100 | |

| Pre-requisite Course Codes, if any. | |
|---|---|
| **Course Objective:** To equip the students with the fundamental skills involved in the creation of simulated and physical design. | |
| **Course Outcomes (CO):** ***At the End of the course students will be able to*** | |
| AS106.1 | Operate basic electronic equipment and instruments. |
| AS106.2 | Make PCB designs in simulations. |
| AS106.3 | Assemble, disassemble and troubleshoot computer hardware and network peripherals. |
| AS106.4 | Fabricate basic jobs in traditional trades. |
| AS106.5 | Design a 3D model and translate it to a 3D printed component. |

**CO-PO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AS106.1 | | | | | | | | | | | | |
| AS106.2 | | | | | | | | | | | | |
| AS106.3 | | | | | | | | | | | | |
| AS106.4 | | | | | | | | | | | | |
| AS106.5 | | | | | | | | | | | | |

**CO-PEO/PSO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)**

| | PEO1 | PEO2 | PEO3 | PEO4 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|
| AS106.1 | | | | | | | |
| AS106.2 | | | | | | | |
| AS106.3 | | | | | | | |
| AS106.4 | | | | | | | |
| AS106.5 | | | | | | | |

**BLOOM'S Levels Targeted (Pl. Tick appropriate)**

| Remember | Understand | Apply | Analyze | Evaluate | Create |
|---|---|---|---|---|---|

# Department of Computer Engineering

**Lab Component**

| Trade No. | Unit No. | Topics | Ref. | Hrs. |
|---|---|---|---|---|
| 1 | Unit 1 | **Electronic Components** | 5 | 4 |
| | 1.1 | **Introduction to Electronic Components**<br>Exposure to usual electronic equipment/instruments such as Multi-meter, Oscilloscope, Function generator, IC tester and Power supply, Information about their front panels, Demonstrations on their working, Hands-on for measurement of component values and DC voltage using multi-meter, AC mains voltage/1 KHz Square wave/any small signal from function generator on Oscilloscope, Testing of sample digital ICs using IC tester.<br>**OR**<br>**Repairing of gadgets and appliances:**<br>Elementary skills of repairing juicer, mixer, grinder, etc. | | |
| 2 | Unit 2 | **PCB Laboratory Exercises** | 6 | 4 |
| | 2.1 | Layout drawing, Positive and negative film making, PCB etching and drilling, Tinning and soldering technique. | | |
| 3 | Unit 3 | **Hardware and Networking** | 7, 8 | 4 |
| | 3.1 | Dismantling of a Personal Computer (PC), Identification of Components of a PC such as power supply, motherboard, processor, hard disk, memory (RAM, ROM), CMOS battery, CD drive, monitor, keyboard, mouse, printer, scanner, pen drives, disk drives etc. | | |
| | 3.2 | Assembling of PC, Installation of Operating System and Device drivers, Boot-up sequence. Installation of application software (at least one). | | |
| | 3.3 | Basic troubleshooting and maintenance. | | |
| | 3.4 | Identification of network components: LAN card, wireless card, switch, hub, router, different types of network cables (straight cables, crossover cables, rollover cables) Basic networking and crimping. | | |
| 4 | Unit 4 | **Traditional Trades*** | 1, 2 | 4 |
| | | **Carpentry**<br>Use and setting of hard tools like hacksaws, jack planes, chisels and gauges for construction of various joints, wood turning and modern wood turning methods. One carpentry job involving a joint and report on demonstration of a job involving wood turning required for successful completion of module.<br>OR<br>**Electrical board wiring**<br>House wiring, staircase wiring, and wiring diagram for fluorescent tube light, Godown wiring and three phase wiring for electrical motors. | | |

| | | | | |
|---|---|---|---|---|
| | | OR<br>**Sheet Metal Practice**<br>Introduction to primary technology processes involving bending, punching and drawing various sheet metal joints, development of joints. Utility job in sheet metal required for successful completion of module. | | |
| **5** | **Unit 5** | **3D Modeling and Printing** | 3, 4 | **4** |
| | **5.1** | Modeling approaches for ideation and creation. Developing a CAD file (.iges/.step/.dwg) of a 3D model and export it as an .stl file for the purpose of 3D printing. Importing the 3D .stl file to generate a .gcode file for 3D printing through slicing, using open source software. | | |
| | **5.2** | Introduction to 3D printing: methodologies, best practices, material and model variation. Live printing sessions of generated .gcode files in real time with optimal parameters and troubleshooting. | | |
| | | | **Total** | **20** |

*** Students can opt for any one of the three trades from Unit 4.**

**Text Books:**

| Sr. No. | Title | Edition | Authors | Publisher | Year |
|---|---|---|---|---|---|
| 1 | Workshop Manual | Sixth | Venkat Reddy | BS Publication | 2008 |
| 2 | Wiring Simplified: Based on 2017 National Electrical Code | Forty Fifth | Frederic P Hartwell, Herbert P. Richter, W.C. Schwan | Park Publishing | 2017 |

**Reference Books:**

| Sr. No. | Title | Edition | Authors | Publisher | Year |
|---|---|---|---|---|---|
| 3 | Autocad 2017 | First | Shyam Tikoo | Dreamtech Press | 2016 |
| 4 | Ultimaker 2+ reference manual | - | - | Ultimaker | 2017 |
| 5 | Encyclopedia of Electronic Components | First | Charles Platt | O Reilly | 2012 |
| 6 | Printed Circuit Boards | First | Khandpur R. S. | Tata McGraw Hill | 2005 |
| 7 | Troubleshooting Your PC For Dummies | Second | Gookin Dan | For Dummies | 2005 |
| 8 | Networking For Dummies | Eighth | Lowe Doug | For Dummies | 2007 |

## Department of Computer Engineering

# Department of Computer Engineering

| Sem III | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| No | Type | Code | Course | L | T | P | O | E | C |
| 1 | BSC | MA203 | Probability and Statistics | 3 | 0 | 0 | 5 | 08 | 3 |
| 1 | BSC* | MA202 | Foundation of Mathematics-I* | 2 | 1 | 0 | 6 | 09 | 3 |
| 2 | PC | CE201 | Discrete Structures and Graph Theory | 3 | 0 | 0 | 4 | 07 | 3 |
| 3 | PC | CE202 | Data Structures | 3 | 0 | 2 | 5 | 10 | 4 |
| 4 | PC | CE203 | Computer Architecture and Organization | 3 | 0 | 2 | 4 | 09 | 4 |
| 5 | PC | CE204 | Database Management Systems | 3 | 0 | 2 | 5 | 10 | 4 |
| 6 | ABL | SVXX/STXX | SEVA II or III /SATVA II or III | 0 | 0 | 0 | 3 | 03 | 1 |
| 7 | HSSE | HSEX1 | HSS-I | 2 | 0 | 0 | 3 | 05 | 2 |
| | | | **TOTAL** | **19** | **1** | **6** | **35** | **61** | **24** |

**Only for Lateral Entry Students*

| Sem IV | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| No | Type | Code | Course | L | T | P | O | E | C |
| 1 | BSC | MA201 | Linear Algebra | 2 | 0 | 2 | 5 | 09 | 3 |
| 1 | BSC* | MA204 | Foundation of Mathematics-II | 2 | 1 | 0 | 6 | 09 | 3 |
| 2 | PC | CE205 | Design and Analysis of Algorithms | 3 | 0 | 2 | 5 | 10 | 4 |
| 3 | PC | CE206 | Operating Systems | 3 | 0 | 2 | 5 | 10 | 4 |
| 4 | PC | CE207 | Computer Communications and Networks | 3 | 0 | 2 | 5 | 10 | 4 |
| 5 | SBC | CE208 | Mini Project-I | 0 | 0 | 0 | 4 | 04 | 2 |
| 6 | ABL | SVXX/STXX | SEVA II or III /SATVA II or III | 0 | 0 | 0 | 3 | 01 | 1 |
| 7 | HSSE | HSEX2 | HSS-II | 2 | 0 | 0 | 3 | 05 | 2 |
| 8 | SBC | AS201 | Professional Communication Skills | 1 | 0 | 2 | 2 | 05 | 2 |
| 9 | S/M | SCX1/MNX1 | SCOPE-I/Minor-I | | | | | | 3 |
| | | | TOTAL | **14** | **0** | **10** | **32** | **56** | **22** |

**Only for Lateral Entry Students*

| Second Summer for HSC students | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| No | Type | Code | Course | L | T | P | O | E | C |
| 1 | MLC | AS202 | Constitution of India | 1 | 0 | 0 | 05 | 06 | NC |

| Second Summer (For Lateral Entry Students) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| No | Type | Code | Course | L | T | P | O | E | C |
| 1 | BSC | MA201 | Linear Algebra | 2 | 0 | 2 | 5 | 09 | 3 |
| 1 | BSC | MA203 | Probability and Statistics | 3 | 0 | 0 | 5 | 08 | 3 |
| 2 | MLC | AS202 | Constitution of India | | | | 06 | 06 | NC |

Bharatiya Vidya Bhavan's
**Sardar Patel Institute of Technology**
(Autonomous Institute Affiliated to University of Mumbai)
Bhavan's Campus, Munshi Nagar, Andheri (West), Mumbai-400058-India

**Department of Computer Engineering**

# Semester-III

# Department of Computer Engineering

| Course (Category) Code | Course Name | Teaching Scheme (Hrs/week) | | | | | Credits Assigned | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | L | T | P | O | E | L | T | P | Total |
| (BSC) | Probability and Statistics | 3 | 0 | 0 | 5 | 8 | 3 | 0 | 0 | 3 |
| MA203 | | Examination Scheme | | | | | | | | |
| | | Component | ISE | | MSE | | ESE | | Total | |
| | | Theory | 75 | | 75 | | 150 | | 300 | |
| | | Laboratory | -- | | -- | | -- | | -- | |

| | |
|---|---|
| **Pre-requisite Course Codes, if any.** | - |
| **Course Objective:** To give an exposure to the students the basic concepts of Probability and Statistical methods and their application. | |
| **Course Outcomes (CO): At *the End of the course students will be able to*** | |
| MA203.1 | Familiarize with basic probability axioms, rules and their applicability. |
| MA203.2 | Identify the characteristics of various discrete and continuous distributions. |
| MA203.3 | Find unbiased and efficient estimates using estimation theory. |
| MA203.4 | Test the hypothesis for means and variances using 't' & F; chi-square distribution tests. |
| MA203.5 | Find Correlation and Regression and fit different types of curves. |

**CO-PO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MA203.1 | 2 | | | | | | | | | | | |
| MA203.2 | | 2 | | | | | | | | | | |
| MA203.3 | | 2 | | | | | | | | | | |
| MA203.4 | | 2 | | | | | | | | | | |
| MA203.5 | | 2 | | | | | | | | | | |

**CO-PEO/PSO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)**

| | PEO1 | PEO2 | PEO3 | PEO4 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|
| MA203.1 | 2 | | | | | | |
| MA203.2 | 2 | | | | | | |
| MA203.3 | 2 | | | | | | |
| MA203.4 | 2 | | | | | | |
| MA203.5 | 2 | | | | | | |

**BLOOM'S Levels Targeted (Pl. Tick appropriate)**

| Remember | Understand | Apply ✓ | Analyze | Evaluate | Create |
|---|---|---|---|---|---|
| | | | | | |

# Department of Computer Engineering

**Theory Component**

| Module No. | Unit No. | Topics | Ref. | Hrs. |
|---|---|---|---|---|
| **1** | **Title** | **Probability and Random Variables** | **1, 2** | **12** |
| | **1.1** | Classical, relative frequency and axiomatic definitions of probability, addition rule and multiplication rule. Conditional Probability, Bayes' theorem and independence. | | 04 |
| | **1.2** | Discrete, continuous and mixed random variables, probability mass function (PMF), Probability Density Function (PDF) and cumulative distribution function (CDF). Joint Distributions: Joint, marginal and conditional distribution. | | 04 |
| | **1.3** | Mathematical expectation, moments, moments generating function, Chebyshev's inequality. | | 04 |
| **2** | **Title** | **Probability Distributions** | **1, 2** | **12** |
| | **2.1** | Standard discrete distributions: Bernoulli, Binomial, Poisson and Geometric distributions, Probability density function, Cumulative distribution function, Expectation and Variance, | | 06 |
| | **2.2** | Standard continuous distributions – Uniform, Normal, Exponential, Joint distribution and Joint density functions | | 06 |
| **3** | **Title** | **Test of Hypothesis and Significance** | **1, 2** | **12** |
| | **3.1** | Statistical hypothesis, Null and Alternate hypothesis, test of hypothesis and significance, Type I and Type II errors, Level of Significance, Tests involving the Normal distribution, One-Tailed and Two-Tailed tests, P value. | | 03 |
| | **3.2** | Special tests of significance for Large samples and Small samples (F, chi- square, z, t- test), ANOVA. | | 09 |
| **4** | **Title** | **Correlation and Regression** | **1, 2** | **06** |
| | **4.1** | Correlation, Rank correlation, Regression Analysis, Linear and Non-linear Regression, Multiple regressions, Curve fitting by method of least squares, fitting of straight lines, Polynomials, Exponential curves. | | |
| **5** | **Self-Study** | 1. Applicability of Bayes theorem<br>2. Proofs for mean & variance for all distribution: included in module 2<br>3. Examples to test goodness of fit using Chi-square | | 01*<br>02*<br><br>02* |
| | | | **Total** | **42** |

*** Not included in Total 42 hrs.**

**Text Books**

| Sr. No. | Title | Edition | Authors | Publisher | Year |
|---|---|---|---|---|---|
| **1** | Introduction to Probability and Statistics for Engineers and Scientists | Fourth | Sheldon M. Ross | Academic Foundation | 2011 |
| **2** | Probability and Statistics for Engineers and Scientists | Eighth | E. Walpole, R. H. Mayers, S. L. Mayers and K. Ye | Pearson Education | 2007 |

**Reference Books**

| Sr. No. | Title | Edition | Authors | Publisher | Year |
|---|---|---|---|---|---|
| 1 | Probability and Statistics in Engineering | Fifth | Douglas C. Montgomery | Wiley India | 2012 |
| 2 | Probability & Statistics | Third | Spiegel, M. R., Schiller, J. and Srinivasan, R. A. | Tata McGraw Hill | 2010 |

# Department of Computer Engineering

| Course (Category) Code | Course Name | Teaching Scheme (Hrs/week) | | | | | Credits Assigned | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | L | T | P | O | E | L | T | P | Total |
| (BSC) | Foundations of Mathematics-I | 2 | 1 | 0 | 6 | 9 | 2 | 1 | 0 | 3 |
| | | Examination Scheme | | | | | | | | |
| MA202 | | Component | ISE | | MSE | | ESE | | Total | |
| | | Theory | 75 | | 75 | | 150 | | 300 | |
| | | Laboratory | -- | | -- | | -- | | -- | |

| | |
|---|---|
| **Pre-requisite Course Codes, if any.** | - |
| **Course Objective:** To develop basic foundation of mathematical skills. | |
| **Course Outcomes (CO): At *the End of the course students will be able to:-*** | |
| MA202.1 | Differentiate a function of one variable and partially differentiate a function of more than one variable. |
| MA202.2 | Apply the concept of partial differentiation to find extreme values of a given function. |
| MA202.3 | Find nth order derivative of a given function. |
| MA202.4 | Expand a given function as a power series. |
| MA202.5 | Perform operations on matrices and find inverses and determinants of them. |
| MA202.6 | Perform vector operations and compute dot products and cross products between them. |

**CO-PO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MA202.1 | 2 | | | | | | | | | | | |
| MA202.2 | 2 | | | | | | | | | | | |
| MA202.3 | 2 | | | | | | | | | | | |
| MA202.4 | 1 | | | | | | | | | | | |
| MA202.5 | 1 | | | | | | | | | | | |
| MA202.6 | 1 | | | | | | | | | | | |

**CO-PEO/PSO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)**

| | PEO1 | PEO2 | PEO3 | PEO4 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|
| MA202.1 | | | | | | |
| MA202.2 | | | | | | |
| MA202.3 | | | | | | |
| MA202.4 | | | | | | |
| MA202.5 | | | | | | |
| MA202.6 | | | | | | |

**BLOOM'S Levels Targeted (Pl. Tick appropriate)**

| | | | | | |
|---|---|---|---|---|---|
| **Remember** ✓ | **Understand** ✓ | **Apply** ✓ | **Analyze** | **Evaluate** | **Create** |

# Department of Computer Engineering

**Theory Component**

| Module No. | Unit No. | Topics | Ref | Hrs. |
|---|---|---|---|---|
| **1** | **Title** | **Differential Calculus** | 1,2 | **18** |
| | **1.1** | Partial fractions. Derivatives of standard functions, product and quotient rule for differentiation. | | 04 |
| | **1.2** | Partial derivatives of first and higher order, composite differentiation | | 03 |
| | **1.3** | Application of partial derivatives: Local Maxima and Minima of functions of two variables. | | 02 |
| | **1.4** | Successive Differentiation: Proofs of nth derivatives of standard functions. Use of partial fractions to calculate nth derivatives of given functions. Leibnitz theorem for nth derivative of product of two functions. | | 05 |
| | **1.5** | Infinite series: expansion of functions in powers of x using maclaurin series. Taylor's series. | | 04 |
| **2** | **Title** | **Matrices** | 1,2 | **07** |
| | **2.1** | Addition and scalar multiplication of matrices. Matrix multiplication, types of matrices. | | 03 |
| | **2.2** | Elementary row transformations, finding inverses using matrices, determinants and its properties | | 04 |
| **3** | **Title** | **Vectors** | 1,2 | **03** |
| | **3.1** | Vector definition, addition, scalar multiplication, dot product of two vectors, angle between two vectors, cross product. | | 03 |
| | | | **Total** | **28** |

**Text Books**

| Sr. No. | Title | Edition | Authors | Publisher | Year |
|---|---|---|---|---|---|
| 1 | Higher Engineering Mathematics | Forty Forth | Dr. B. S. Grewal | Khanna Publications | 2020 |

**Reference Books**

| Sr. No. | Title | Edition | Authors | Publisher | Year |
|---|---|---|---|---|---|
| 1 | Advanced Engineering Mathematics | Tenth | Erwin Kreysizg | John Wiley & Sons | 2011 |
| 2 | Advanced Engineering Mathematics | Twenty Eighth | H. K. Dass | S. Chand Publications | 2014 |

# Department of Computer Engineering

| Course (Category) Code | Course Name | Teaching Scheme (Hrs/week) | | | | | Credits Assigned | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | L | T | P | O | E | L | T | P | Total |
| (PC) | Discrete Structures and Graph Theory | 3 | 0 | 0 | 4 | 7 | 3 | 0 | 0 | 3 |
| | | Examination Scheme | | | | | | | | |
| CE201 | | Component | ISE | | MSE | | ESE | | Total | |
| | | Theory | 75 | | 75 | | 150 | | 300 | |
| | | Laboratory | -- | | -- | | -- | | -- | |

| | |
|---|---|
| **Pre-requisite Course Codes, if any.** | |
| **Course Objective:** To teach students how to think logically and mathematically. It provides the mathematical foundation that is used in most areas of computer science. | |
| **Course Outcomes (CO): At *the End of the course students will be able to*** | |
| CE201.1 | Solve problems using set theory, logic and its various proof techniques. |
| CE201.2 | Apply the concepts of relations, functions, lattices and recurrence relations to solve problems |
| CE201.3 | Apply the concepts of graph, trees and their various types with their traversing techniques to solve problems. |
| CE201.4 | Apply the basics of coding theory and cryptography to solve real world problems. |

**CO-PO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CE201.1 | 3 | | | | | | | | | | | |
| CE201.2 | 3 | 2 | | | | | | | | | | |
| CE201.3 | 3 | | | | | | | | | | | |
| CE201.4 | 3 | 2 | 2 | | | | | | | | | 2 |

**CO-PEO/PSO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)**

| | PEO1 | PEO2 | PEO3 | PEO4 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|
| CE201.1 | | | 2 | | | | |
| CE201.2 | | | 2 | | | | |
| CE201.3 | | | 2 | | | | |
| CE201.4 | | | 2 | | | | |

**BLOOM'S Levels Targeted (Pl. Tick appropriate)**

| Remember | Understand | Apply ✓ | Analyze | Evaluate | Create |
|---|---|---|---|---|---|

# Department of Computer Engineering

**Theory Component**

| Module No. | Unit No. | Topics | Ref. | Hrs. |
|---|---|---|---|---|
| 1 | Title | **Set Theory, Logic and Proofs** | 1, 2 | |
| | 1.1 | Finite and infinite set, Union, Intersection, Disjoint, and Difference of two sets. Power Set, Partition of Sets, Ordered Sets, De Morgan's Laws, Principle of Inclusion Exclusion | | 2 |
| | 1.2 | Predicates, Propositions, Conditional Propositions, Logical Connectivity, Proposition calculus, Universal and Existential Quantifiers, First order logic, Equivalence, Normal Forms, Introduction to proofs, Mathematical Induction, Strong Induction, Well-ordering principle, Logical inference | | 6 |
| 2 | Title | **Relations, Functions and Lattices** | 1, 2 | |
| | 2.1 | Product Sets and Partitions, Paths in relations and Diagraphs, Properties of Relations, Closure of Relation, Equivalence Relations, Operations on Relations, Warshall's Algorithm, Partially Ordered Sets, External Elements of Partially Ordered Sets, Hasse Diagram | | 8 |
| | 2.2 | Composition of Functions, Invertible Functions, Recursive Functions, Hashing, Pigeon hole Principle, Extended PHP | | 3 |
| | 2.3 | Lattice, Sub lattice, Isomorphic Lattices, Properties of Lattice, Special Types of Lattices | | 4 |
| | 2.4 | Recurrence Relations – Introduction, Linear Recurrence Relations with constant coefficients, Homogeneous solutions, Particular Solutions, Total Solutions, Solution by the method of Generating functions, solving Recurrence Relations | | 5 |
| 3 | Title | **Graph Theory** | 1, 2 | 4 |
| | 3.1 | Concepts and terminologies, Graphs as Model (Konigsberg Bridge Problem) | | |
| | 3.2 | Matrices, Isomorphism, Bipartite Graphs, Directed Graphs | | |
| | 3.3 | Minimal Spanning Trees-Prim's Algorithm and Kruskal's Algorithm | | |
| 4 | Title | **Graph connectivity** | 1, 2 | 6 |
| | 4.1 | Cycles – Transport Networks, Max Flows, Matching Problems, Maximum Bipartite Matching, Perfect Matching | | |
| | 4.2 | Euler Paths- Circuits, Hamiltonian Paths- Circuits | | |
| | 4.3 | Coloring Graphs, Chromatic Polynomial, Planer Graphs | | |
| 5 | Title | **Coding Theory** | 1, 2 | 4 |
| | 5.1 | Hamming Code, Minimum Distance | | |
| | 5.2 | Number Theory, Modular Arithmetic and applications to cryptography; Diffie-Hellman Algorithm | | |

| | | | | |
|---|---|---|---|---|
| **6** | **Self-Study** | Algebraic Structures - Semi group, Monoids, Groups, Cyclic groups, Abelian groups, Normal Subgroups | **1, 2** | **5*** |
| | | | **Total (*Not included)** | **42** |

**Text Books**

| Sr. No. | Title | Edition | Authors | Publisher | Year |
|---|---|---|---|---|---|
| 1 | Discrete Mathematics and it's applications | Seventh | Kenneth H. Rosen | Tata McGraw-Hill | 2013 |
| 2 | Discrete Mathematical Structures | Sixth | Bernad Kolman, Robert Busby, Sharon Cutler Ross, Nadeem-ur-Rehman | Pearson Education | 2015 |

**Reference Books**

| Sr. No. | Title | Edition | Authors | Publisher | Year |
|---|---|---|---|---|---|
| 1 | Elements of Discrete Mathematics | Fourth | C. L. Liu | Tata McGraw-Hill | 2012 |
| 2 | Introduction to graph Theory | Second | Douglas B. West | Pearson Education | 2015 |
| 3 | Discrete Mathematical Structures with Applications to Computer Science | First | Jean-Paul, Tremblay R. Manohar | Tata McGraw-Hill | 1987 |

# Department of Computer Engineering

| Course (Category) Code | Course Name | Teaching Scheme (Hrs/week) | | | | | Credits Assigned | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | L | T | P | O | E | L | T | P | Total |
| (PC) | Data Structures | 3 | 0 | 2 | 5 | 10 | 3 | 0 | 1 | 4 |
| | | Examination Scheme | | | | | | | | |
| CE202 | | Component | ISE | | MSE | | ESE | | Total | |
| | | Theory | 75 | | 75 | | 150 | | 300 | |
| | | Laboratory | 50 | | -- | | 50 | | 100 | |

| | |
|---|---|
| **Pre-requisite Course Codes, if any.** | 1. Problem solving using imperative programming |
| **Course Objective:** To introduce the fundamentals and abstract concepts of Data Structures for Problem Solving. | |
| **Course Outcomes (CO): At *the End of the course students will be able to*** | |
| CE202.1 | Apply various operations of linear and non-linear data structures to given problems. |
| CE202.2 | Apply the concepts of Trees and Graphs to a given problem. |
| CE202.3 | Apply various operations of heap data structures. |
| CE202.4 | Apply the concepts of hashing on a given problem |

**CO-PO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CE202.1 | 3 | | 3 | | | | | | 3 | 3 | 3 | |
| CE202.2 | 3 | | 3 | | | | | | 3 | 3 | 3 | |
| CE202.3 | 3 | | 3 | | | | | | 3 | 3 | 3 | |
| CE202.4 | 3 | | 3 | | | | | | 3 | 3 | 3 | |

**CO-PEO/PSO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)**

| | PEO1 | PEO2 | PEO3 | PEO4 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|
| CE202.1 | | | 1 | | | 1 | |
| CE202.2 | | | 1 | | | 1 | |
| CE202.3 | | | 1 | | | 1 | |
| CE202.4 | | | 1 | | | 1 | |

**BLOOM'S Levels Targeted (Pl. Tick appropriate)**

| Remember | Understand | Apply ✔ | Analyze | Evaluate | Create |
|---|---|---|---|---|---|

# Department of Computer Engineering

**Theory Component**

| Module No. | Unit No. | Topics | Ref. | Hrs. |
|---|---|---|---|---|
| **1** | **Title** | **Introduction to Data Structures** | | |
| | 1.1 | Concept of Linear and Nonlinear Data Structures | 1,2 | **1** |
| | 1.2 | Stack: Stack as ADT, operations on stack, Applications of Stacks | 1,2 | **4** |
| | 1.3 | Queue: Queue as ADT, Operations on Queue, Applications of Queue, Types of Queue-Circular and Priority Queue | 1,2 | **4** |
| | 1.4 | Linked List: Linked List as ADT, Operations on Singly Linked List. Types of linked list- Linear and circular linked lists, Doubly Linked List, Circular Linked List and its operations, Generalized Linked List (GLL) concept, Applications of linked List and Generalized Linked List (GLL). | 1,2 | **6** |
| **2** | **Title** | **Trees** | | |
| | 2.1 | Trees as ADT, General tree v/s Binary Tree Terminology, Traversal of Binary Tree, Operations on Binary tree, Binary Search Tree and its operations, Expression Tree | 1,2 | **5** |
| | 2.2 | AVL Trees- Properties of AVL trees, Rotations, Insertion, and Deletion | 1,2 | **4** |
| | 2.3 | Introduction to B tree- Insertion, Deletion. | 1,2 | **3** |
| **3** | **Title** | **Graphs** | | |
| | 3.1 | Graph as ADT, Introduction to Graph, Representation of Graph- Adjacency Matrix, Adjacency List, Graph Traversal Technique | 1,2 | **3** |
| **4** | **Title** | **Heap Structure** | | |
| | 4.1 | Heap as ADT, Introduction to Heap Structures, Min Heap, Max Heap, Construction of Heap | 1,2 | **3** |
| | 4.2 | Fibonacci heaps- Structure of Fibonacci heaps, Mergeable-heap, operations, decreasing a key and deleting a node | 1,2 | **5** |
| **5** | **Title** | **Hashing** | | |
| | 5.1 | Introduction to Hash Table, Hash functions, Collision Resolution Technique. | 1,2 | **4** |
| **6** | **Self-Study** | **Optimal Binary Search Tree and Red-Black Trees** | **1,2** | **5*** |
| | | | **Total** | **42** |

**Laboratory Component, if any (Minimum 10 Laboratory experiments are expected)**

| Sr. No. | Title of the Experiment |
|---|---|
| 1 | Implement a given problem statement using Stack. |
| 2 | Implement a given problem statement using Queue |
| 3 | Implement a given problem statement using Linked List. |
| 4 | Implement a given problem statement using Doubly Linked List. |
| 5 | Implement a given problem statement using Binary Trees. |
| 6 | Implement insertion of node in AVL tree. |

| | |
|---|---|
| 7 | Implementation of expression tree |
| 8 | Implement Operations of Heap Structures. |
| 9 | Implement hash functions with different collision resolution techniques. |
| 10 | Apply Graph Traversal Technique on a given problem statement to solve the problem |

**Text Books**

| Sr. No. | Title | Edition | Authors | Publisher | Year |
|---|---|---|---|---|---|
| 1 | Introduction to Algorithms | Third | Thomas H. Cormen, Charles E. Leiserson, Ronald L Rivest, Clifford Stein | MIT Press | 2009 |
| 2 | Fundamentals of Computer Algorithms | Second | Horowitz E, Sahni S and S. Rajasekaran | Galgotia Publications | 2010 |

**Reference Books**

| Sr. No. | Title | Edition | Authors | Publisher | Year |
|---|---|---|---|---|---|
| 1 | Classic Data Structures | Second | Samanta Debasis | PHI | 2009 |
| 2 | Data Structures With C | First | Seymour Lipschutz | Schaum's Outline Series | 2010 |

# Department of Computer Engineering

| Course (Category) Code | Course Name | Teaching Scheme (Hrs/week) | | | | | Credits Assigned | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | L | T | P | O | E | L | T | P | Total |
| (PC) | Computer Architecture and Organization | 3 | 0 | 2 | 4 | 9 | 3 | 0 | 1 | 4 |
| CE203 | | Examination Scheme | | | | | | | | |
| | | Component | ISE | | MSE | | ESE | | | Total |
| | | Theory | 75 | | 75 | | 150 | | | 300 |
| | | Laboratory | 50 | | -- | | 50 | | | 100 |

| | |
|---|---|
| **Pre-requisite Course Codes, if any.** | Digital Circuits & Systems, Any Programming Language |
| **Course Objective:** Imparting concepts of each component of computer architecture thoroughly with practical aspects including memory systems and I/O communications with interfacing | |
| **Course Outcomes (CO):** ***At the End of the course students will be able to*** | |
| CE203.1 | Explain basic computer structure and compare computer architecture models |
| CE203.2 | Design algorithms to solve ALU operations and memory mapping techniques |
| CE203.3 | Comprehend processor architecture with various design methods of CPU with comparative analysis |
| CE203.4 | Illustrate memory systems with design and analysis of mapping techniques for cache and virtual memory |
| CE203.5 | Analyze different parallel processing and pipelining concepts with pipelining hazards |
| CE203.6 | Comprehend different types of I/O buses , compare and contrast different types of data transfer methods and arbitration techniques |

**CO-PO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CE203.1 | 3 | | | | | | | | | | | |
| CE203.2 | | 3 | | | 3 | | | 3 | | 3 | | |
| CE203.3 | 3 | 2 | | | | | | | | | | |
| CE203.4 | | 2 | 1 | | | | | | | | | |
| CE203.5 | | 2 | 1 | | | | | | | | | |
| CE203.6 | 3 | | | | | | | | | | | |

**CO-PEO/PSO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)**

| | PEO1 | PEO2 | PEO3 | PEO4 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|
| CE203.1 | | | | | | | |
| CE203.2 | | | | | | | |
| CE203.3 | | | | | | | |
| CE203.4 | | | | | | | |
| CE203.5 | | | | | | | |
| CE203.6 | | | | | | | |

**BLOOM'S Levels Targeted (Pl. Tick appropriate)**

| Remember | Understand | Apply | Analyze ✔ | Evaluate | Create |
|---|---|---|---|---|---|

# Department of Computer Engineering

**Theory Component**

| Module No. | Unit No. | Topics | Ref. | Hrs. |
|---|---|---|---|---|
| 1 | **Title** | **Overview of Computer Architecture and Organization** | | 5 |
| | **1.1** | Introduction of Computer Organization and Architecture, Basic organization of computer and block level description of the functional units, Evolution of x86 Computers, Von Neumann model, Harvard Model, Embedded system | 1 | |
| | **1.2** | Performance Issues: Designing for performance, Amdahl's Law, Multi-core, GPGPU | 1 | |
| 2 | **Title** | **Data Representation and Arithmetic Algorithms** | | 6 |
| | **2.1** | Number representation: Floating-point representation, Floating point arithmetic, IEEE 754 floating point number representation | 2,3 | |
| | **2.2** | Integer Data computation: Addition, Subtraction. Multiplication: Signed multiplication, Booth's algorithm. | 2,3 | |
| | **2.3** | Division of integers: Restoring and non-restoring division | 2,3 | |
| 3 | **Title** | **Processor Organization and Control Unit** | | 9 |
| | **3.1** | CPU Architecture, Register Organization<br>Instruction formats, basic instruction cycle. Instruction interpretation and sequencing,<br>Case Study of 8086 architecture and Register Organization | 1,2,4 | |
| | **3.2** | Control Unit: Soft wired (Micro-programmed) and hardwired control unit design methods. Microinstruction sequencing and execution. Micro operations | 2,4 | |
| | **3.3** | RISC and CISC: Introduction to RISC and CISC architectures and design issues. | 2,4 | |
| 4 | **Title** | **Memory Organization** | | 11 |
| | **4.1** | Introduction to Memory and Memory parameters. Classifications of primary and secondary memories. Types of RAMS and ROM, Allocation policies, Memory hierarchy and characteristics. | 1,2 | |
| | **4.2** | Cache memory: Concept, architecture (L1, L2, L3), mapping techniques. Cache Coherency, Interleaved and Associative memory. | 1,2 | |
| | **4.3** | Virtual Memory: Concept, Segmentation and Paging, Page replacement policies | 1,2,4 | |
| 5 | **Title** | **I/O Organization and Introduction to Parallel Processing** | | 11 |
| | **5.1** | Buses: Types of Buses, Bus Arbitration, BUS standards | 2 | |
| | **5.2** | I/O Interface, I/O channels, I/O modules and IO processor, Types of data transfer techniques: Programmed I/O, Interrupt driven I/O and DMA. | 1,2 | |
| | **5,3** | Introduction to parallel processing concepts, Flynn's classifications, pipeline processing, Pipeline stages, Pipeline Hazards | 1,2,4 | |

| | | | | |
|---|---|---|---|---|
| **6** | **Self-Study** | Comparative Study of microprocessors and micro architectures with respect to their important features.8086 instructions and assembler directives with addressing modes with memory interfacing techniques. Cache memory protocol and virtual memory concepts in Pentium processors. Vector and Array Processors with VLIW architecture. | Ref. 2,5,6 | **6*** |
| | | | **Total (* Not included)** | **42** |

**Laboratory Component (Minimum 10 Laboratory experiments are expected)**

| Sr. No. | Title of the Experiment |
|---|---|
| **1** | Implement various Arithmetic Operations through Assembly Language Programming for microprocessor 8086 (MASM) |
| **2** | Simulate the operation of COPY and PASTE in 8086 (MASM) |
| **3** | Implement various String Operations in 8086 through the utilities provided by DOS interrupts (MASM) |
| **4** | Generation of alphabetic arrangement of a given string in 8086 (MASM) |
| **5** | Design password application (generation and detection) in 8086 (MASM/C) |
| **6** | Design of Carry Look Ahead Adder |
| **7** | Implement Booth's Multiplication Algorithm |
| **8** | Implement Division Algorithm (Non-Restoring and Restoring) |
| **9** | Implement Mapping techniques of Cache memory |
| **10** | Implement Page Replacement Policies |

**Text Books**

| Sr. No. | Title | Edition | Authors | Publisher | Year |
|---|---|---|---|---|---|
| 1 | Computer Organization | Fifth | Carl Hamacher, Zvonko Vranesic, Safwat Zaky | Tata McGraw-Hill | 2002 |
| 2 | Computer Organization and Architecture: Designing for Performance | Eighth | William Stallings | Pearson | 2010 |
| 3 | Computer System Architecture | Third | M, Morris Mano | Pearson | 2007 |
| 4 | Computer Architecture & Organization | Third | John P. Hayes | McGraw-Hill | 1998 |

**Reference Books**

| Sr. No. | Title | Edition | Authors | Publisher | Year |
|---|---|---|---|---|---|
| 1 | Structured Computer Organization | Sixth | Andrew S. Tanenbaum | Pearson | 2013 |
| 2 | Microprocessor and Interfacing: Programming & Hardware | Third | Douglas V Hall | Tata-McGraw Hill | 2012 |
| 3 | Computer Architecture and Organization: Design Principles and Applications | Second | B. Govindarajulu | McGraw Hill | 2017 |
| 4 | Programmer's reference Manual for IBM Personal Computers | First | Steven Armburst | McGraw Hill | 1986 |
| 5 | Pentium Processor System Architecture | Second | Don Anderson, Tom Shanley, MindShare Inc, MindShare, Inc | Addison-Wesley Professional | 1995 |
| 6 | Modern Processor Design: Fundamentals of Superscalar Processors | Second | John Paul Shen , Mikko H. Lipasti | Waveland Press Inc. | 2013 |

# Department of Computer Engineering

| Course (Category) Code | Course Name | Teaching Scheme (Hrs/week) | | | | | Credits Assigned | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | L | T | P | O | E | L | T | P | Total |
| (PC) | Database Management Systems | 3 | 0 | 2 | 5 | 10 | 3 | 0 | 1 | 4 |
| | | Examination Scheme | | | | | | | | |
| CE204 | | Component | ISE | | MSE | | ESE | | | Total |
| | | Theory | 75 | | 75 | | 150 | | | 300 |
| | | Laboratory | 50 | | -- | | 50 | | | 100 |

| | |
|---|---|
| **Pre-requisite Course Codes, if any.** | - |
| **Course Objective:** To efficiently and effectively Design, develop, maintain and retrieve the Information from DBMS. | |
| **Course Outcomes (CO): At *the End of the course students will be able to*** | |
| CE204.1 | Demonstrate understanding of given system to construct a database model. |
| CE204.2 | Apply various Relational and SQL commands on the populated database. |
| CE204.3 | Examine the functional dependencies to make a normalized database system. |
| CE204.4 | Examine transaction processing techniques on a database. |
| CE204.5 | Illustrate query processing and optimization method on a database. |

**CO-PO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CE204.1 | 1 | 2 | 2 | 2 | 2 | 1 | | 1 | 2 | | | 2 |
| CE204.2 | 2 | 2 | 2 | | 2 | | | | | | | |
| CE204.3 | 1 | 2 | 2 | | 2 | | | | | | | |
| CE204.4 | 1 | 2 | | | 2 | | | | | | | |
| CE204.5 | 2 | 2 | | | | | | | | | | |

**CO-PEO/PSO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)**

| | PEO1 | PEO2 | PEO3 | PEO4 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|
| CE204.1 | | | | | | 3 | |
| CE204.2 | | | | | | | |
| CE204.3 | | | | | | | |
| CE204.4 | | | | | | | |
| CE204.5 | | | | | | | |

**BLOOM'S Levels Targeted (Pl. Tick appropriate)**

| Remember | Understand | Apply | Analyze ✔ | Evaluate | Create |
|---|---|---|---|---|---|

# Department of Computer Engineering

**Theory Component**

| Module No. | Unit No. | Topics | Ref. | Hrs. |
|---|---|---|---|---|
| 1 | **Title** | **Introduction: Database Concepts and ER Modeling** | 1,2 | **09** |
| | **1.1** | Introduction to basic concept of Database, Characteristics of databases, File system V/s Database system, Users of Database system, Database Administrator, Data Independence, Codd's Rule, DBMS system architecture. | | |
| | **1.2** | Introduction to ER model, Benefits of Data Modeling, Types of data Models, Phases of Database Modeling, The Entity-Relationship (ER) Model, Extended Entity-Relationship (EER) Model | | |
| 2 | **Title** | **Relational Algebra and SQL** | 1,2 | **16** |
| | **2.1** | Introduction, Mapping the ER and EER Model to the Relational Model, Relational Algebra: Overview, Basic Operators, Extended Operators | | |
| | **2.2** | Overview of SQL, Data Definition Commands, Data Manipulation commands, Data Control commands, Set operations, aggregate function, null values, Views in SQL, Subquery, Trigger, stored procedure | | |
| 3 | **Title** | **Normalization** | 1,2 | **06** |
| | **3.1** | Design guidelines for relational schema, Functional dependencies | | |
| | **3.2** | Normal Forms- 1NF, 2 NF, 3NF, BCNF and 4NF,5NF | | |
| 4 | **Title** | **Transaction Processing and Recovery** | 1,2 | **07** |
| | **4.1** | Transaction concept, Transaction states, ACID properties, Implementation of atomicity and durability, Concurrent Executions, Serializability, Recoverability, Lock-based, Timestamp-based, Validation-based protocols. | | |
| | **4.2** | Shadow paging, Deadlock handling. | | |
| 5 | **Title** | **Introduction to Query Processing and Query Optimization** | 1,2 | **04** |
| | **5.1** | Basics of Query Processing, Measures of Query Cost | | |
| | **5.2** | Query Optimization: Equivalence Rules, Pictorial representations | | |
| 6 | **Self-Study** | 1. Relational Calculus-Information retrieval<br>2. NO SQL-Data type, Database creation, Basic command for creation, updating and querying the database, Mongo dB | 1,2 | **5*** |
| | | | **Total (*Not included)** | **42** |

# Department of Computer Engineering

**Laboratory Component:**
Assign a case study for group of 2/3 students and each group will perform following experiments on the case study.

| Exp No. | Title of the Experiment |
|---|---|
| 1 | Formulate a case study and create an E-R Diagram.<br>Mapping of E-R model to Relational Model. |
| 2 | To create a database and populate using SQL commands (With constraints)<br>• Data Definition Language- Create, Alter, Drop, Rename, Truncate<br>• Data Manipulation Language- Insert, Update, Delete, Select<br>• Constraints-Not Null, Unique Key, Primary Key, Foreign Key, Check, Dropping a Constraint. |
| 3 | To perform DCL, TCL commands<br>• Data Control Language: Grant, Revoke, Roles<br>• Transaction Control Language: Commit, Rollback, Save point |
| 4 | To perform Date, Time, Arithmetic and Set operation on database. |
| 5 | To perform Aggregate function and Group by- Having clause on database |
| 6 | To perform Join operations on database.<br>• Equijoins, Non-Equijoins, Self Joins, Outer Join, cross Join |
| 7 | To retrieve a data using Sub query. |
| 8 | To Create a different view of database. |
| 9 | To examine integrity of database using Triggers. |
| 10 | To improve performance of system using stored procedure. |

**Textbooks**

| Sr. No. | Title | Edition | Authors | Publisher | Year |
|---|---|---|---|---|---|
| 1 | Database System Concepts | Seventh | Korth, Slberchatz, Sudarshan | McGraw – Hill | 2019 |
| 2 | Fundamentals of Database Systems | Sixth | Elmasri and Navathe | PEARSON Education | 2011 |

**Reference Books**

| Sr. No. | Title | Edition | Authors | Publisher | Year |
|---|---|---|---|---|---|
| 1 | Database Management Systems | Third | Raghu Ramkrishnan and Johannes Gehrke | TMH | 2003 |
| 2 | Database Management Systems | First | G. K. Gupta | McGraw – Hill. | 2018 |
| 3 | SQL, PL/SQL programming language of ORACLE | Forth | Ivan Bayross | BPB | 2010 |

Bharatiya Vidya Bhavan's
**Sardar Patel Institute of Technology**
(Autonomous Institute Affiliated to University of Mumbai)
Bhavan's Campus, Munshi Nagar, Andheri (West), Mumbai-400058-India

**Department of Computer Engineering**

# Semester-IV

# Department of Computer Engineering

| Course (Category) Code | Course Name | Teaching Scheme (Hrs/week) | | | | | Credits Assigned | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | L | T | P | O | E | L | T | P | Total |
| (BSC) | Linear Algebra | 2 | 0 | 2 | 5 | 9 | 2 | 0 | 1 | 3 |
| | | Examination Scheme | | | | | | | | |
| MA201 | | Component | ISE | | MSE | | ESE | | | Total |
| | | Theory | 50 | | 50 | | 100 | | | 200 |
| | | Laboratory | 50 | | -- | | 50 | | | 100 |

| | |
|---|---|
| **Pre-requisite Course Codes, if any.** | Engineering Calculus/Foundation of Mathematics-I and Differential Equations and Complex Analysis/Foundation of Mathematics-II |
| **Course Objective:** To develop mathematical skills for solving engineering problems. | |
| **Course Outcomes (CO): At *the End of the course students will be able to:*** | |
| MA201.1 | Solve a homogeneous and non-homogeneous system of linear equations using rank of a matrix. |
| MA201.2 | Solve system of linear equations by Numerical Methods. |
| MA201.3 | Solve equations in real life problems and to encode and decode messages using the concept of matrices. |
| MA201.4 | Identify whether given structures are vector spaces and subspaces and construct a basis for them. |
| MA201.5 | Show if a given matrix is diagonalizable or not. |
| MA201.6 | Apply concepts of eigenvalues and eigenvectors to calculate functions of a square matrix, google page rank vector and solve systems of differential equations using diagonalization of matrices. |

**CO-PO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MA201.1 | 3 | | | | | | | | | | | |
| MA201.2 | 3 | | | | | | | | | | | |
| MA201.3 | 3 | 1 | | | | | | | | | | |
| MA201.4 | 3 | | | | | | | | | | | |
| MA201.5 | 3 | | | | | | | | | | | |
| MA201.6 | 3 | 1 | | | | | | | | | | |

**CO-PEO/PSO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)**

| | PEO1 | PEO2 | PEO3 | PEO4 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|
| MA201.1 | | | | | | | |
| MA201.2 | | | | | | | |
| MA201.3 | | | | | | | |
| MA201.4 | | | | | | | |
| MA201.5 | | | | | | | |
| MA201.6 | | | | | | | |

# Department of Computer Engineering

**BLOOM'S Levels Targeted (Pl. Tick appropriate)**

| Remember ✔ | Understand ✔ | Apply ✔ | Analyze | Evaluate | Create |
|---|---|---|---|---|---|

**Theory Component**

| Module No. | Unit No. | Topics | Ref | Hrs. |
|---|---|---|---|---|
| **1** | **Title** | **Basics of matrices** | **3,5** | **03** |
| | **1.1** | Revision of basic matrices and types of matrices. | | 01 |
| | **1.2** | Row echelon form, Reduced Row Echelon form, Rank of a matrix. | | 02 |
| **2** | **Title** | **Linear equations & its solutions** | **1,2,3,5** | **07** |
| | **2.1** | Consistency and solution of simultaneous linear homogeneous and non-homogeneous equations. | | 02 |
| | **2.2** | Application of solving systems of equations in traffic control. | | 01 |
| | **2.3** | Solution of system of linear algebraic equations, by<br>(1) Gauss Elimination Method<br>(2) Gauss Jordan method<br>(3) Gauss Jacobi Iteration method<br>(4) Gauss Seidel Method.<br>(5) LU Decomposition -Crout's method | | 04 |
| **3** | **Title** | **Vector spaces (over field of real numbers)** | **1,2,5** | **08** |
| | **3.1** | Vector space, subspace, span, linear dependence and independence of vectors, basis, dimension, orthogonal projection & gram-Schmidt process. Null space, row space, column space, Rank-Nullity theorem (only statement). Least square method. | | 08 |
| **4** | **Title** | **Encoding & decoding using Matrices.** | **4** | **02** |
| | **4.1** | Application of matrices to Coding and Decoding | | 02 |
| **5** | **Title** | **Eigenvalues and Eigenvectors** | **1,2,3,5** | **08** |
| | **5.1** | Eigenvalues, Eigenvectors and its properties. Cayley Hamilton theorem and its applications. Diagonalization of matrices. Derogatory and Non-derogatory matrices. | | 04 |
| | **5.2** | Application to find google page rank. Functions of a square matrix. Solving system of differential equations using diagonalization. | | 04 |
| **6** | **Self-Study** | 1.2 Normal form.<br>2.2 Forming equations using KVL for circuits and solving them using matrices.<br>3.1 Singular Value Decomposition.<br>5.1 Additional properties with proofs of eigenvalues and eigenvectors. | **1,2,3,5** | 05 |
| | | | **Total** | **28*** |

# Department of Computer Engineering

***Total of 28 hours does not include the self-study hours.**

**Laboratory Component (Minimum 10 Laboratory experiments are expected)**

| Sr. No. | Title of the Experiment |
|---|---|
| **1** | Introduction to Scilab (getting started) and its benefits to use as a mathematics tool. |
| **2** | Basic commands of Scilab and vectors & matrix operations. |
| **3** | Conditional branching and iterations using Scilab. |
| **4** | Solution of linear equations using row-echelon and inverse of a matrix. |
| **5** | Solutions of linear equations using Gauss Elimination method. |
| **6** | Solutions of linear equations using Gauss Jordan method. |
| **7** | Solutions of linear equations using Gauss-Jacobi method. |
| **8** | Solutions of linear equations using Gauss-Seidel method. |
| **9** | Solutions of linear equations using Crout's method. |
| **10** | To find Eigenvalues and Eigenvectors using Scilab |

**Text Books**

| Sr. No. | Title | Edition | Authors | Publisher | Year |
|---|---|---|---|---|---|
| 1 | Linear Algebra and its applications | Fourth | Gilbert Strang | Cengage | 2014 |
| 2 | Higher Engineering Mathematics | Forty Fourth | Dr. B. S. Grewal | Khanna Publications | 2020 |

**Reference Books**

| Sr. No. | Title | Edition | Authors | Publisher | Year |
|---|---|---|---|---|---|
| 1 | Linear Algebra and its applications | Third | David. C. Lay | Pearson Education | 2006 |
| 2 | Elementary Linear Algebra Application Version | Sixth | H Anton and Crorres | John Wiley and Sons | 2010 |
| 3 | Advanced Engineering Mathematics | Twenty Eighth | H.K Das | S. Chand | 2014 |
| 4 | Hill Ciphers | First | Jonaki B Ghosh | At Right Angles | 2015 |
| 5 | Advanced Engineering Mathematics | Tenth | Erwin Kreysizg | John Wiley & Sons | 2011 |

# Department of Computer Engineering

| Course (Category) Code | Course Name | Teaching Scheme (Hrs/week) | | | | | Credits Assigned | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | L | T | P | O | E | L | T | P | Total |
| (BSC) | Foundations of Mathematics-II | 3 | 0 | 0 | 6 | 9 | 2 | 1 | 0 | 3 |
| | | Examination Scheme | | | | | | | | |
| MA204 | | Component | ISE | | MSE | | ESE | | Total | |
| | | Theory | 75 | | 75 | | 150 | | 300 | |
| | | Laboratory | -- | | -- | | -- | | -- | |

| | |
|---|---|
| **Pre-requisite Course Codes, if any.** | Foundations of Mathematics-I |
| **Course Objective:** To develop basic foundation of mathematical skills. | |
| **Course Outcomes (CO): At *the End of the course students will be able to: -*** | |
| MA204.1 | Integrate a function of one variable using various techniques |
| MA204.2 | Sketch basic curves and solve double and triple integrals. |
| MA204.3 | Solve basic problems using properties of complex numbers. |
| MA204.4 | Solve differential equations of first order. |
| MA204.5 | Apply the techniques of solving first order differential equations to electrical engineering problems. |
| MA204.6 | Solve differential equations of higher order |

**CO-PO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MA204.1 | 1 | | | | | | | | | | | |
| MA204.2 | 1 | | | | | | | | | | | |
| MA204.3 | 1 | | | | | | | | | | | |
| MA204.4 | 2 | | | | | | | | | | | |
| MA204.5 | 1 | 1 | | | | | | | | | | |
| MA204.6 | 2 | | | | | | | | | | | |

**CO-PEO/PSO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)**

| | PEO1 | PEO2 | PEO3 | PEO4 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|
| MA204.1 | | | | | | |
| MA204.2 | | | | | | |
| MA204.3 | | | | | | |
| MA204.4 | | | | | | |
| MA204.5 | | | | | | |
| MA204.6 | | | | | | |

**BLOOM'S Levels Targeted (Pl. Tick appropriate)**

| Remember ✔ | Understand ✔ | Apply ✔ | Analyze | Evaluate | Create |
|---|---|---|---|---|---|

# Department of Computer Engineering

**Theory Component**

| Module No. | Unit No. | Topics | Ref | Hrs. |
|---|---|---|---|---|
| 1 | **Title** | **Integral Calculus** | 1,2 | **13** |
| | **1.1** | Formulae for integral of standard functions, integration by parts, integration by method of substitution. | | 04 |
| | **1.2** | Gamma functions, Beta functions. Differentiation under Integral sign with constant limits and one parameter. | | 04 |
| | **1.3** | Standard curves (lines, circles, parabolas, ellipses). Concept of double integration. Evaluation of double and triple integrals. | | 05 |
| 2 | **Title** | **Complex Numbers** | 1,2 | **03** |
| | **2.1** | Operations on complex numbers, polar form of a complex number, properties of a complex number. | | 03 |
| 3 | **Title** | **Differential Equations** | 1,2 | **12** |
| | **3.1** | Exact differential equations. Linear differential equations of the first order and equations reducible to linear. | | 04 |
| | **3.2** | Solving differential equations of first order in electrical networks. | | 01 |
| | **3.3** | Linear differential equations with constant coefficients: complementary function and particular integral. | | 07 |
| **Total** | | | | **28** |

**Text Books**

| Sr. No. | Title | Edition | Authors | Publisher | Year |
|---|---|---|---|---|---|
| 1 | Higher Engineering Mathematics | Forty Fourth | Dr. B. S. Grewal | Khanna Publications | 2020 |

**Reference Books**

| Sr. No. | Title | Edition | Authors | Publisher | Year |
|---|---|---|---|---|---|
| 1 | Advanced Engineering Mathematics | Tenth | Erwin Kreysizg | John Wiley & Sons | 2011 |
| 2 | Advanced Engineering Mathematics | Twenty Eighth | H. K. Dass | S. Chand | 2014 |

# Department of Computer Engineering

| Course (Category) Code | Course Name | Teaching Scheme (Hrs/week) | | | | | Credits Assigned | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | L | T | P | O | E | L | T | P | Total |
| (PC) | Design and Analysis of Algorithms | 3 | 0 | 2 | 5 | 10 | 3 | 0 | 1 | 4 |
| CE205 | | Examination Scheme | | | | | | | | |
| | | Component | ISE | | MSE | | ESE | | Total | |
| | | Theory | 75 | | 75 | | 150 | | 300 | |
| | | Laboratory | 50 | | -- | | 50 | | 100 | |

| | |
|---|---|
| **Pre-requisite Course Codes, if any.** | Advanced Data Structures |
| **Course Objective:** 1. To teach paradigms and approaches used to analyze and design algorithms and to appreciate the impact of algorithm design in practice.<br>2. To make students understand how the worst-case time complexity of an algorithm is defined, how asymptotic notation is used to provide a classification of algorithms. | |
| **Course Outcomes (CO): At *the End of the course students will be able to*** | |
| CE205.1 | Analyze time and space complexity of an algorithm. |
| CE205.2 | Apply divide and conquer strategy to solve problems. |
| CE205.3 | Apply the concept of dynamic programming and greedy approach to solve problems. |
| CE205.4 | Apply the idea of backtracking, branch and bound strategy to solve problems. |
| CE205.5 | Apply various string matching algorithms. |

**CO-PO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CE205.1 | 3 | 2 | | | | | | 1 | | 1 | | 1 |
| CE205.2 | 3 | 2 | 2 | 1 | | | | 1 | 1 | 1 | | 1 |
| CE205.3 | 3 | 2 | 2 | 1 | | | | 1 | 1 | 1 | | 1 |
| CE205.4 | 3 | 2 | 2 | 1 | | | | 1 | 1 | 1 | | 1 |
| CE205.5 | 3 | 2 | 2 | | | | | 1 | 1 | 1 | | 1 |

**CO-PEO/PSO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)**

| | PEO1 | PEO2 | PEO3 | PEO4 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|
| CE205.1 | | | | | | | |
| CE205.2 | 1 | | 1 | | | 1 | |
| CE205.3 | 1 | | 1 | | | 1 | |
| CE205.4 | 1 | | 1 | | | 1 | |
| CE205.5 | 1 | | 1 | | | 1 | |

**BLOOM'S Levels Targeted (Pl. Tick appropriate)**

| Remember | Understand | Apply | Analyze ✓ | Evaluate | Create |
|---|---|---|---|---|---|

# Department of Computer Engineering

**Theory Component**

| Module No. | Unit No. | Topics | Ref. | Hrs. |
|---|---|---|---|---|
| 1 | **Title** | **Introduction to Analysis of algorithm** | | 12 |
| | **1.1** | Role of Algorithms in Computing, Performance analysis-space and time complexity, Growth of Functions: Asymptotic Notation, Standard Notation and Common Functions, Analysis of sorting algorithms Such as Selection sort and insertion sort. | 1,2 | |
| | **1.2** | Divide and Conquer Approach – General Method, Analysis of Merge Sort, Analysis of Quick sort, Analysis of Binary search, Finding the maximum and minimum, Strassen's matrix multiplication. | 1,2 | |
| | **1.3** | Recurrences: The substitution method, Recursion tree method, Master method and Proof. | 1 | |
| 2 | **Title** | **Dynamic Programming and Amortized Analysis** | | 12 |
| | **2.1** | Dynamic Programming: Assembly-line scheduling, Matrix Chain Multiplication, longest common subsequence. | 1 | |
| | **2.2** | Amortized analysis- Aggregate analysis, accounting and Potential Method, Dynamic Table. | 1 | |
| 3 | **Title** | **Greedy Approach** | | 5 |
| | **3.1** | Greedy Approach: Basic strategy, application to job sequencing with deadlines problem, single source shortest path-Dijkstra's algorithm. | 1,2 | |
| | **3.2** | Knapsack problem, Minimum cost spanning trees-Kruskal and prim's algorithm. | 1,2 | |
| 4 | **Title** | **Backtracking and Branch-and-bound** | | 5 |
| | **4.1** | Backtracking: General method, 8 queen problem (N-queen problem), Sum of subsets, Graph coloring. | 2 | |
| | **4.2** | Branch and Bound: 0/1 knapsack problem, travelling salesman problem, 15 puzzle problem. | 2 | |
| 5 | **Title** | **Approximation and String-Matching algorithms** | | 8 |
| | **5.1** | **Approximation algorithms:** The vertex-cover problem, the traveling-salesman problem, the set covering problem | 1 | |
| | **5.2** | **String Matching algorithms:** The naïve string-matching Algorithms, The Rabin Karp algorithm, String matching with finite automata, The Knuth-Morris-Pratt algorithm | 1 | |
| 6 | **Self-Study** | **NP-complete problems:** Basic concepts, non-deterministic Algorithms, NP-hard and NP-complete, Cook's Theorem, NP-Hard graph and scheduling Problems. NP-completeness and reducibility, decision and optimization problems, polynomial reduction | 1,2 | **5*** |
| **Total** | | | | **42** |

# Department of Computer Engineering

**Laboratory Component (Minimum 10 Laboratory experiments are expected)**

| Sr. No. | Title of the Experiment |
|---|---|
| 1 | Experiment on finding the running time of an algorithm. |
| 2 | Experiment based on divide and conquers approach. |
| 3 | Experiment on Recurrence relation. |
| 4 | Experiment using dynamic programming approach |
| 5 | Experiment based on greedy approach |
| 6 | Experiment based on graph Algorithms |
| 7 | Experiment using Backtracking strategy |
| 8 | Experiment using branch and bound strategy |
| 9 | Experiment based on Approximation Algorithms |
| 10 | Experiment on string matching algorithms. |

**Text Book(s):**

| Sr. No. | Title | Edition | Authors | Publisher | Year |
|---|---|---|---|---|---|
| 1 | Introduction to Algorithms | Third | Thomas H. Cormen, Charles E. Leiserson, Ronald L Rivest, Clifford Stein | MIT Press | 2009 |
| 2 | Fundamentals of Computer Algorithms | Second | Horowitz E, Sahni S and S. Rajasekaran | Galgotia Publications | 2010 |

**Reference Books:**

| Sr. No. | Title | Edition | Authors | Publisher | Year |
|---|---|---|---|---|---|
| 1 | The Design and analysis of algorithms | First | Alfred V. Aho, John E. Hopcroft and Jeffrey D. Ullman | Pearson Education India | 2006 |

# Department of Computer Engineering

| Course (Category) Code | Course Name | Teaching Scheme (Hrs/week) | | | | | Credits Assigned | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | L | T | P | O | E | L | T | P | Total |
| (PC) | Operating Systems | 3 | 0 | 2 | 5 | 10 | 3 | 0 | 1 | 4 |
| | | Examination Scheme | | | | | | | | |
| | | Component | ISE | | MSE | | ESE | | | Total |
| CE206 | | Theory | 75 | | 75 | | 150 | | | 300 |
| | | Laboratory | 50 | | -- | | 50 | | | 100 |

| | |
|---|---|
| **Pre-requisite Course Codes, if any.** | Computer Architecture and Organization |
| **Course Objective:** To understand structure of OS, process synchronization, memory management and file system. | |
| **Course Outcomes (CO): At *the End of the course students will be able to*** | |
| CE206.1 | Comprehend the primitive concepts of Operating System services and System Programming functionality. |
| CE206.2 | Articulate process scheduling algorithms in effective execution of processes. |
| CE206.3 | Acquaint with efficient process synchronization techniques in effective execution of programs. |
| CE206.4 | Analyze virtual memory management algorithms in effective allocation of main memory usage. |
| CE206.5 | Evaluates various algorithms of File Storage & I/O management for performance and quality criterion. |

**CO-PO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CE206.1 | 1 | | | | | | | | | | | 1 |
| CE206.2 | 2 | 2 | 2 | 2 | | | | | 2 | | | 2 |
| CE206.3 | 2 | 2 | 2 | 2 | | | | | 2 | | | 2 |
| CE206.4 | 2 | 2 | 2 | 2 | | | | | 2 | | | 2 |
| CE206.5 | 2 | 2 | 2 | 2 | | | | | 2 | | | 2 |

**CO-PEO/PSO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)**

| | PEO1 | PEO2 | PEO3 | PEO4 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|
| CE206.1 | | | | | | | |
| CE206.2 | | | | | | | |
| CE206.3 | | | | | | 2 | |
| CE206.4 | | | | | | | |
| CE206.5 | | | | | | | |

**BLOOM'S Levels Targeted (Pl. Tick appropriate)**

| Remember | Understand | Apply ✓ | Analyze | Evaluate | Create |
|---|---|---|---|---|---|

# Department of Computer Engineering

**Theory Component**

| Module No. | Unit No. | Topics | Ref. | Hrs. |
|---|---|---|---|---|
| 1 | **Title** | **Introduction to System Software and Operating Systems** | | 8 |
| | **1.1** | **System Software** – Introduction, Goal, Systems Programs and Systems Programming, Views of Systems Software. **Linkers and Loader** – Relocation and Linking Concepts, Design of Linker, Self-Relocating Programs, Linking of Overlay Structured Programs, Dynamic Linking, Loaders. | 1 | |
| | **1.2** | **Operating Systems** – Introduction, Structure and Principles of Operations of Operating Systems, Classes of Operating Systems, Batch Processing Systems, Multiprogramming Systems, Time Sharing Systems, Real Time Operating Systems. | 1 | |
| 2 | **Title** | **Process Management** | | 8 |
| | **2.1** | **Processes and Threads** – Process Concept, Process Scheduling, Operations on Processes, Multicore Programming, Multithreading Models, Thread Libraries, Implicit Threading, Threading Issues, Operating-System Examples | 2 | |
| | **2.2** | **UNIX Process and Threads –** Process Abstraction, Process Creation using fork and exec, invoking new process, process termination, awaiting process termination, User and Kernel Threads. | 3 | |
| 3 | **Title** | **Process Coordination** | | 12 |
| | **3.1** | **Process Synchronization** - Critical-Section Problem, Peterson's Solution, Synchronization Hardware, Mutex Locks, Semaphores, Classic Problems of Synchronization, Monitors, Synchronization Examples | 2 | |
| | **3.2** | **CPU Scheduling** - Scheduling Criteria, Scheduling Algorithms, Real-Time CPU Scheduling, Operating-System Examples. **Deadlock** - Characterization, Methods for Handling Deadlocks, Detection, Prevention, Avoidance, Recovery methods for Deadlock. | 2 | |
| | **3.3** | **UNIX IPC –** Universal IPC Facilities, System V IPC, Message, Ports, Message Passing, Port Operations. | 3 | |
| 4 | **Title** | **Memory management** | | 6 |
| | **4.1** | **Memory Management Strategies** - Swapping, Contiguous Memory Allocation, Segmentation, Paging, Structure of the Page Table. | 2 | |
| | **4.2** | **Virtual Memory Management** - Demand Paging, Allocation of Frames, Thrashing, Memory-Mapped Files, Allocating Kernel Memory, Operating-System Examples. | 2 | |
| 5 | **Title** | **File Management** | | 8 |
| | **5.1** | **Storage Management** - Disk Structure, Disk Scheduling, Disk Management | 2 | |

| | | | | |
|---|---|---|---|---|
| | **5.2** | **File-System Implementation** - File-System Structure, File-System Implementation, Directory Implementation, Allocation Methods, Free-Space Management | 2 | |
| | **5.3** | **UNIX Internal File Representation** - Inodes, Structure of Regular File, Directories, Path Name to Inode Conversion, Super Block, Inode Assignment, Allocation of Disk blocks, Other File Types. | 4 | |
| **6** | **Self-Study** | 1) Explore Features, characteristics and CPU scheduling of Real-Time Operating System along an example<br>2) Explore the requirements of Kernel, CPU Scheduling, Disk Scheduling for Multimedia Systems<br>3) Explore all UNIX System Calls for File System. | 2,4 | **5*** |
| | | | **Total (*Not included)** | **42** |

**List of Experiments for Operating System Laboratory**

| Sr. No. | Title of the Experiment |
|---|---|
| 1 | Installation of Linux OS on Virtual Machine. |
| 2 | Write a program for creating a static/dynamic link library for complex number operations and then test this library through linuxld linker. |
| 3 | Write a program which creates exactly 16 copies of itself by calling fork () only twice within a loop. The program should also print a tree of the pids. |
| 4 | Write a program to simulate the following non-preemptive CPU scheduling algorithms to find turnaround time and waiting time. a) FCFS b) SJF c) Round Robin d) Priority |
| 5 | The program r.c initializes *n* number of semaphores. It first assigns count equal -1, which is then used by process p and q. This count is protected by semaphore. It also allocates shared memory of size 40 ints. It waits for process p and q to enter all n1 and n2 elements through different terminals. This program r.csorts shared data in ascending order. It waits to finish p and q. At end, the program r.c detaches and deletes *n* semaphores and print the sorted list. |
| 6 | Write a multithreaded program for preventing race conditions and deadlock avoidance for the banker's algorithm as follows. Several customers' request and release resources from the bank. The banker will grant a request only if it leaves the system in a safe state. A request that leaves the system in an unsafe state will be denied. |
| 7 | Write a program which acts as a chat application between two users on the same computer using shared memory. |
| 8 | Assume that a system has a 32-bit virtual address with a 4-KB page size. Write a C program that is passed a virtual address (in decimal) on the command line and have it output the page number and offset for the given address. As an example, your program would run as follows:<br>./a.out 19986<br>Your program would output:<br>The address 19986 contains:<br>page number = 4<br>offset = 3602<br>Writing this program will require using the appropriate data type to store 32 bits. We encourage you to use unsigned data types as well. |

| | |
|---|---|
| 9 | Write a program to simulate disk scheduling algorithms a) FCFS b) SCAN c) C-SCAN |
| 10 | Write a program to prevent destructive update of files by locking as follows: Suppose the inode contains a new permission setting such that it allows only one process at a time to open the file for writing, but many processes can open the file for reading. |

**Note – Implement all programs in C language under Linux OS environment**

**Text Books**

| Sr. No. | Title | Edition | Authors | Publisher | Year |
|---|---|---|---|---|---|
| 1 | System Programming | First | D M Dhamdhere | Tata McGraw-Hill Education | 2011 |
| 2 | Operating System Concepts | Ninth | Abraham Silberschatz, Peter B Galvin, Greg Gagne | Wiley | 2012 |
| 3 | UNIX Internals: The New Frontiers | First | Uresh Vahalia | Prentice Hall | 1995 |
| 4 | Design of the UNIX Operating Systems | First | Maurice J. Bach | Prentice-Hall | 1990 |

**Reference Books**

| Sr. No. | Title | Edition | Authors | Publisher | Year |
|---|---|---|---|---|---|
| 1 | Operating Systems: Internals and Design Principles | Eighth | William Stallings | Pearson | 2014 |
| 2 | Modern Operating Systems | Fourth | Andrew S. Tanenbaum, Herbert Bos | Pearson | 2014 |

# Department of Computer Engineering

| Course (Category) Code | Course Name | Teaching Scheme (Hrs/week) | | | | | Credits Assigned | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | L | T | P | O | E | L | T | P | Total |
| (PC) | Computer Communications and Networks | 3 | 0 | 2 | 5 | 10 | 3 | 0 | 1 | 4 |
| | | Examination Scheme | | | | | | | | |
| CE207 | | Component | ISE | | MSE | | ESE | | | Total |
| | | Theory | 50 | | 50 | | 100 | | | 200 |
| | | Laboratory | 50 | | -- | | 50 | | | 100 |

| Pre-requisite Course Codes, if any. | |
|---|---|
| **Course Objective:** Understand the state-of-the-art in network protocols, architectures and applications. | |
| **Course Outcomes (CO): At *the End of the course students will be able to*** | |
| CE207.1 | Describe the fundamental concepts of Data Communication. |
| CE207.2 | Distinguish the different layers of the OSI model and TCP/IP. |
| CE207.3 | Identify the different types of protocols and their functions within a network. |
| CE207.4 | Apply the knowledge of sub netting, routing mechanisms and Software Defined Networking. |

**CO-PO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CE207.1 | 2 | 1 | | | | | | 1 | 1 | | | 2 |
| CE207.2 | 2 | 2 | | | | | | 1 | 1 | | | 2 |
| CE207.3 | 2 | 2 | | | | | | 1 | 1 | | | 2 |
| CE207.4 | 2 | 2 | | | | | | 1 | 1 | | | 2 |

**CO-PEO/PSO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)**

| | PEO1 | PEO2 | PEO3 | PEO4 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|
| CE207.1 | 3 | | | | | | |
| CE207.2 | 3 | | | | | | |
| CE207.3 | 3 | | | | | | |
| CE207.4 | 3 | | | | | | |

**BLOOM'S Levels Targeted (Pl. Tick appropriate)**

| Remember | Understand | Apply ✓ | Analyze | Evaluate | Create |
|---|---|---|---|---|---|
| | | | | | |

# Department of Computer Engineering

**Theory Component**

| Module No. | Unit No. | Topics | Ref. | Hrs. |
|---|---|---|---|---|
| 1 | Title | **Computer Communication and The Internet** | 1,2 | 10 |
| | 1.1 | Internet: A Nut and Bolts Description, A Services Description, Protocol. The Network Edge: Access Network, The Network Core: Packet Switching, Circuit Switching, A Network of Networks | 1,2 | |
| | 1.2 | Delay, Loss, Throughput in Packet Switched Networks: Overview of Delay in Packet Switched Networks, Queuing Delay and Packet Loss, End to End Delay, Throughput in Computer Networks. | 1,2 | |
| | 1.3 | Protocol Layers and their Service Models: Layered Architecture and their Encapsulation. | 1,2 | |
| | 1.4 | Data and Signals: Analog and Digital, Periodic analog signals, Digital signals, Transmission impairment. | 2 | |
| | 1.5 | Digital Transmission: Digital-to-Digital conversion, Analog-to-Digital conversion. Transmission modes, Analog Transmission: Digital-to-Analog conversion, Analog-to-Analog conversion. | 2 | |
| 2 | Title | **Application Layer** | 1,2 | 6 |
| | 2.1 | Principles of Network Applications: Network Applications Architecture, Processes Communicating, Transport Services Available to Applications, Transport Services Provided by the Internet, Application Layer Protocols. | 1,2 | |
| | 2.2 | The Web and HTTP: Overview of HTTP, Non-Persistent and Persistent Connections, HTTP Message Format, User Server Interaction: Cookies, Web Catching, The Conditional Get. | 1,2 | |
| | 2.3 | File Transfer Ftp: Ftp Commands and Replies. FTP, SMTP, Mail Access Protocol (IMAP, POP), DNS | 1,2 | |
| 3 | Title | **Transport Layer** | 1,2 | 8 |
| | 3.1 | Introduction and Transport-Layer Services: Relationship Between Transport and Network Layers, Overview of the Transport Layer in the Internet | 1,2 | |
| | 3.2 | Multiplexing and Demultiplexing | 1,2 | |
| | 3.3 | Connectionless Transport - UDP: UDP Segment Structure, UDP Checksum | 1,2 | |
| | 3.4 | Principles of Reliable Data Transfer: Building a Reliable Data Transfer Protocol, Pipelined Reliable Data Transfer Protocols, Go-Back-N (GBN), Selective Repeat (SR), | 1,2 | |
| | 3.5 | Connection-Oriented Transport - TCP: The TCP Connection, TCP Segment Structure, Round-Trip Time Estimation and Timeout, Reliable Data Transfer, Flow Control, TCP Connection Management | 1,2 | |
| | 3.6 | Principles of Congestion Control: The Causes and the Costs of Congestion, Approaches to Congestion Control. | 1,2 | |
| 4 | Title | **The Network Layer** | 1,2 | 10 |

| | | | | |
|---|---|---|---|---|
| | **4.1** | Introduction: Forwarding and Routing, Network Service Models. | 1,2 | |
| | **4.2** | Virtual Circuit and Datagram Networks: Virtual-Circuit Networks, Datagram Networks, Origins of VC and Datagram Networks. | 1,2 | |
| | **4.3** | Router: Input Processing, Switching, Output Processing, Queuing, The Routing Control Plane. | 1,2 | |
| | **4.4** | The Internet Protocol (IP): Forwarding and Addressing in the Internet, Datagram Format, IPv4 Addressing, Internet Control Message Protocol (ICMP), IPv6 | 1,2 | |
| | **4.5** | Routing Algorithms: The Link-State (LS) Routing Algorithm, The Distance-Vector (DV) Routing Algorithm, Hierarchical Routing | 1,2 | |
| | **4.6** | Software Defined Networking: Introduction and Overview | R3 | |
| **5** | **Title** | **The Link Layer: Links, Access Networks, and LANs** | 1,2 | **8** |
| | **5.1** | Introduction to the Link Layer: The Services Provided by the Link Layer, Implementation of the Link Layer | 1,2 | |
| | **5.2** | Error-Detection and Correction Techniques: Parity Checks, Check summing Methods, Cyclic Redundancy Check (CRC) | 1,2 | |
| | **5.3** | Multiple Access Links and Protocols: Channel Partitioning Protocols, Random Access Protocols, Taking-Turns Protocols. | 1,2 | |
| **6*** | **Title** | **Self-Study Topic** | 1,2 | **5*** |
| | **6.1** | Transmission Media: Guided media, Unguided media: Wireless | 1,2 | |
| | **6.2** | ARP and RARP usage | 1,2 | |
| | **6.3** | Multicast routing and Broadcast routing | 1,2 | |
| | **6.4** | Routing in the Internet: Intra-AS Routing in the Internet: RIP, Intra-AS Routing in the Internet: OSPF, Inter-AS Routing: BGP | 1,2 | |
| | **6.5** | Network Function Virtualization | R3 | |
| **Total** | | | | **42** |

***This module hrs. not included in Total 42 hrs**

**Laboratory Component (Minimum 10 Laboratory experiments are expected)**

| Sr. No. | Title of the Experiment |
|---|---|
| **1** | Use and interpret basic Networking Utilities |
| **2** | Describe various Network Topology and Networking Hardware |
| **3** | Experiment with Packet Tracers/Analyzers |
| **4** | Implement Web server and DHCP server for given scenario |
| **5** | Implement TELNET and FTP server for given scenario |
| **6** | Implement SMTP server for given scenario |
| **7** | Implement DNS server for given scenario |
| **8** | Develop client-server model using Socket Programming for given scenario |
| **9** | Illustrate basic Mininet operations for Software Defined Networking |
| **10** | Implement in Mininet to control switch manually |

**Text Books**

| Sr. No. | Title | Edition | Authors | Publisher | Year |
|---|---|---|---|---|---|
| 1 | Computer Networking: Top Down Approach | Sixth | James Kurose and Kieth Ross | Pearson | 2013 |
| 2 | Data Communication and Networking | Second | Behrouz Forouzan | McGraw Hill | 2000 |

**Reference Books**

| Sr. No. | Title | Edition | Authors | Publisher | Year |
|---|---|---|---|---|---|
| 1 | Computer Networks | Fifth | Andrew Tanenbaum | Pearson | 2013 |
| 2 | Computer Networks | Third | Larry L. Peterson and Bruce Davie | Morgon Huffman | 2003 |
| 3 | SDN and NFV Simplified | First | Jim Doherty | Addison Wesley | 2016 |

# Department of Computer Engineering

| Course (Category) Code | Course Name | Teaching Scheme (Hrs/week) | | | | | Credits Assigned | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | L | T | P | O | E | L | T | P | Total |
| (SBC) | Professional Communication Skills | 1 | 0 | 2 | 2 | 5 | 1 | 0 | 1 | 2 |
| AS201 | | Examination Scheme | | | | | | | | |
| | | Component | ISE | | MSE | | ESE | | Total | |
| | | Theory | -- | | -- | | -- | | -- | |
| | | Laboratory | 200 | | -- | | -- | | 200 | |

| Pre-requisite Course Codes, if any. | |
|---|---|
| **Course Objective:** To demonstrate the desired spoken and written communication skills required in early professional life, with focus on job placements. | |
| **Course Outcomes (CO): At *the End of the course students will be able to*** | |
| AS201.1 | Demonstrate the spoken and written skills for job placements. |
| AS201.2 | Draft professional documents. |
| AS201.3 | Design written communication for social media. |

**CO-PO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AS201.1 | | | | | | | | | | 2 | | |
| AS201.2 | | | | | | | | | | 2 | | |
| AS201.3 | | | | | | | | | | 2 | | |

**CO-PEO/PSO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)**

| | PEO1 | PEO2 | PEO3 | PEO4 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|
| AS201.1 | | | | | | | |
| AS201.2 | | | | | | | |
| AS201.3 | | | | | | | |

**BLOOM'S Levels Targeted (Pl. appropriate)**

| Remember | Understand | Apply ✓ | Analyze ✓ | Evaluate | Create |
|---|---|---|---|---|---|

# Department of Computer Engineering

**Theory Component**

| Module No. | Unit No. | Topics | L Hrs. | P Hrs |
|---|---|---|---|---|
| 1. | Title | **Placement Skills** | 6 | 12 |
| | 1.1 | Resume Writing & Cover Letter | | |
| | 1.2 | Group Discussion | | |
| | 1.3 | Case Studies/Pitching a startup | | |
| | 1.4 | Team Building Skills/Work | | |
| | 1.5 | Interview Skills | | |
| 2 | Title | **Corporate Communication** | 6 | 12 |
| | 2.1 | Presentation Skills | | |
| | 2.2 | Meeting: Notice, Agenda, Minutes | | |
| | 2.3 | Proposal Writing | | |
| | 2.4 | Report Writing: Informative, Analytical report | | |
| 3 | Title | **Research Writing** | 2 | 4 |
| | 3.1 | Sourcing information through digital media | | |
| | 3.2 | Written communication using social media: Blog | | |
| 4 | Self-Study | Research Paper, News Analysis | | 6* |
| | | **Total** | 42 hrs | |

***Not included in the total**

**List of ISEs**

| Sr. No. | Title of the Experiment |
|---|---|
| 1 | Resume |
| 2 | Cover Letter |
| 3 | GD |
| 4 | Mock Interview |
| 5 | Presentation |
| 6 | Blog Writing |
| 7 | Team Building Activity |
| 8 | Minutes of the Meeting/Notice & Agenda |
| 9 | Proposal Writing |
| 10 | Report Writing |

**Text Books**

| Sr. No. | Title | Edition | Authors | Publisher | Year |
|---|---|---|---|---|---|
| 1 | Interpersonal Skills at Work | 2002 | John Hayes | McGraw Hill Education | 2002 |
| 2 | Campus Placement: A Comprehensive Guide | 2016 | Ankur Malhotra | McGraw Hill Education | 2016 |

**Reference Books**

| Sr. No. | Title | Edition | Authors | Publisher | Year |
|---|---|---|---|---|---|
| 1 | If I Understood you, Would I Have This Look on My Face? My Adventures in the Art and Science of Relating and Communicating | FIRST | Alan Alda | Random House | 2017 |
| 2 | Handbook for Writing Proposals | SECOND | Robert J. Hamper, Sue Baugh | McGraw Hill Education | 2010 |
| 3 | Effective Communication Skills for Scientific and Technical Professionals | 2000 | Harry Chambers | Paperback Basic Books | 2000 |
| 4 | The Art Of Writing Together | 2008 | William Issac | Crown Business | 2008 |
| 5 | Communication Skills | 2011 | Meenakshi Raman, Sangeeta Sharma | Oxford, India | 2011 |

# Department of Computer Engineering

| Course (Category) Code | Course Name | Teaching Scheme (Hrs/week) | | | | | Credits Assigned | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | L | T | P | O | E | L | T | P | O | Total |
| (SBC) | Mini Project-I | 0 | 0 | 0 | 4 | 4 | 0 | 0 | 0 | 2 | 2 |
| | | Examination Scheme | | | | | | | | | |
| CE208 | | Component | | | ISE | | MSE | | ESE | | Total |
| | | Theory | | | -- | | -- | | -- | | -- |
| | | Laboratory | | | 100 | | -- | | 100 | | 200 |

| Pre-requisite Course Codes, if any. | |
|---|---|
| **Course Objective:** To develop the skills of Planning and Designing the working model for solving the real-world Problem. | |
| **Course Outcomes (CO): At *the End of the course students will be able to*** | |
| CE208.1 | Discover potential research areas for addressing societal issues |
| CE208.2 | Conduct a survey of basic and contemporary literature in the preferred field of study. |
| CE208.3 | Formulate and propose a plan for creating a solution for the research plan identified. |
| CE208.4 | Exercise the team building, communication and management for design and implementation of projects. |
| CE208.5 | Compare and contrast the several existing solutions for research challenge |
| CE208.6 | Report and present the findings of the study conducted in the preferred domain. |

**CO-PO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CE208.1 | 2 | 2 | | | | 2 | | 3 | 3 | 3 | | 2 |
| CE208.2 | 2 | 2 | | | | 2 | | 3 | 3 | 3 | | 2 |
| CE208.3 | 2 | 3 | | | | | 2 | 3 | 3 | 3 | | 2 |
| CE208.4 | 2 | | 3 | 1 | 2 | | | 3 | 3 | 3 | 3 | 2 |
| CE208.5 | 2 | 2 | | 2 | | | | 3 | 3 | 3 | | 2 |
| CE208.6 | 2 | 2 | | | | | | 3 | 3 | 3 | | 2 |

**CO-PEO/PSO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)**

| | PEO1 | PEO2 | PEO3 | PEO4 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|
| CE208.1 | 2 | 2 | 2 | | | 2 | |
| CE208.2 | 2 | 2 | 2 | | | 2 | |
| CE208.3 | 2 | 2 | 2 | | | 2 | |
| CE208.4 | 2 | 2 | 2 | | | 2 | |
| CE208.5 | 2 | 2 | 2 | | | 2 | |
| CE208.6 | 2 | 2 | 2 | | | 2 | |

**BLOOM'S Levels Targeted (Pl. appropriate)**

| Remember | Understand | Apply | Analyze | Evaluate | Create ✔ |
|---|---|---|---|---|---|

## Department of Computer Engineering

Mini-project is an opportunity to make a difference in the experience of education in its own way. It is an attempt of scientific study of the problem in surrounding in order to guide, correct and evaluate the actions and decisions about it. It is based on a small project correlating scientific knowledge and day to day experience which encourages development of scientific attitude to solve real life problems among students.

The Objectives of Action Research are:

- ✓ To make students sensitive towards societal issues
- ✓ To learn scientific principles from day-to-day experiences
- ✓ To develop psycho-technological skills through observation, classification, statement of hypothesis etc.
- ✓ Development of communication, organizational skills and maturity through discussion, presentation etc.
- ✓ To develop ability to correlate science, technology and society
- ✓ To apply engineering knowledge and propose innovative, sustainable solutions to the real-life challenges

**Steps for Implementation (ISE: 2 Phases) and ESE**

- ✓ Keen observation of the surrounding/society
- ✓ Identification of the problem
- ✓ Analysis of the problem
- ✓ Collection of relevant information by formulating research questions
- ✓ Suggesting plan of action
- ✓ Conducting experiments
- ✓ To draw conclusion
- ✓ To find the possible solution to rectify the problem
- ✓ To execute experiments and remedial measures wherever possible

Students can seek guidance from teachers, other experts and make effective use of other sources of information available around them. Students must ensure that problem to be solved in manageable in one semester.

**Criteria of a good project:**

- ✓ Appropriate idea, clear understanding, and proper presentation of the concept
- ✓ Quality of work
- ✓ Project plan and its execution
- ✓ Credibility of the work
- ✓ Probable impact of the work on the attitude of students and society
- ✓ Scientific attitude, creativity and novelty reflected in project work and analysis of the situation
- ✓ Utility and innovation of the remedial measures
- ✓ Desirability, Feasibility and Viability in real life

The H/W and S/W resources required to complete the Mini-Project-I may be beyond the scope of curriculum of courses taken or may be based on the coursesbut thrust should be on

• Learning additional skills
• Development of ability to define and design the problem and lead to its accomplishment with proper planning
• Learn the behavioral discipline by working in a team. The team may be maximum three (03) students.

**Evaluation:**
Project report should contain project title, student details, certificate and acknowledgements. Other sections of the report shall be decided by the department based on projects. But it must have introduction, necessity of project, objectives, hypothesis, plan, observations, analysis of results, conclusion and references along with other sections related to technology. The ISE and ESE evaluation will be carried out based on the rubrics framed by the Department. The ESE marks will be based on final demonstration of the project and viva based on it and report/poster/technical paper of the project in the standard format provided by the Department.

# Department of Computer Engineering

| Sem V | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **No** | **Type** | **Code** | **Course** | **L** | **T** | **P** | **O** | **E** | **C** |
| 1 | PC | CE301 | Theory of Computation | 3 | 0 | 0 | 6 | 9 | 3 |
| 2 | PC | CE302 | Software Engineering | 3 | 0 | 2 | 5 | 10 | 4 |
| 3 | PC | CE303A/ CE303B | Cryptography and System Security/Artificial Intelligence and Machine Learning | 3 | 0 | 2 | 5 | 10 | 4 |
| 4 | PC | CE304 | Distributed Computing | 3 | 0 | 2 | 5 | 10 | 4 |
| 5 | SBC | CE305 | Cloud and Internet Technology Lab | 1 | 0 | 2 | 5 | 08 | 2 |
| 6 | HSSE | HSEX3 | HSS-III | 2 | 0 | 0 | 3 | 05 | 2 |
| 7 | S/M | SCX2/MNX2 | SCOPE-II/Minor-II | | | | | | 3 |
| **TOTAL** | | | | **15** | **0** | **8** | **29** | **52** | **22** |

Bharatiya Vidya Bhavan's
**Sardar Patel Institute of Technology**
(Autonomous Institute Affiliated to University of Mumbai)
Bhavan's Campus, Munshi Nagar, Andheri (West), Mumbai-400058-India

**Department of Computer Engineering**

# Semester-V

# Department of Computer Engineering

| Course (Category) Code | Course Name | Teaching Scheme (Hrs/week) | | | | | Credits Assigned | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | L | T | P | O | E | L | T | P | Total |
| (PC) | Theory of Computation | 3 | 0 | 0 | 6 | 9 | 3 | 0 | 0 | 3 |
| | | Examination Scheme | | | | | | | | |
| CE301 | | Component | ISE | | MSE | | ESE | | Total | |
| | | Theory | 75 | | 75 | | 150 | | 300 | |
| | | Laboratory | -- | | -- | | -- | | -- | |

| | |
|---|---|
| **Pre-requisite Course Codes, if any.** | CS201/IT201: Discrete Structures and Graph Theory |
| **Course Objective:** To give an overview of the theoretical foundations of computer science from the perspective of formal languages which provides the mathematical foundation of formal models of computation, and fundamentals of formal grammars and languages that is used in most areas of computer science. | |
| **Course Outcomes (CO): At *the end of the course students will be able to*** | |
| CE301.1 | Design finite automaton for a regular expressions and languages. |
| CE301.2 | Apply the properties of regular languages. |
| CE301.3 | Construct the grammar for a language and convert it into normal forms. |
| CE301.4 | Design and Evaluate Pushdown Automata and Turing Machine for a language. |

**CO-PO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CE301.1** | 3 | 3 | 2 | - | 1 | - | - | - | 1 | 1 | - | - |
| **CE301.2** | 3 | 2 | - | - | - | - | - | - | 1 | 1 | - | - |
| **CE301.3** | 2 | 3 | - | - | 1 | - | - | - | 1 | 1 | - | - |
| **CE301.4** | 2 | 2 | 2 | - | 1 | - | - | - | 1 | 1 | - | - |

**CO-PEO/PSO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)**

| | PEO1 | PEO2 | PEO3 | PEO4 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|
| **CE301.1** | - | - | - | - | - | - | - |
| **CE301.2** | - | - | - | - | - | - | - |
| **CE301.3** | - | - | - | - | - | - | - |
| **CE301.4** | - | - | - | - | - | - | - |

**BLOOM'S Levels Targeted (Pl. Tick appropriate)**

| Remember | Understand | Apply | Analyze✓ | Evaluate | Create |
|---|---|---|---|---|---|
| | | | | | |

# Department of Computer Engineering

**Theory Component**

| Module No. | Unit No. | Topics | Ref. | Hrs. |
|---|---|---|---|---|
| **1** | **Title** | **Sets, Relations and Languages** | 1,5 | **3** |
| | **1.1** | Relations and functions | | |
| | **1.2** | Alphabets and languages | | |
| | **1.3** | Types of proof | | |
| **2** | **Title** | **Finite Automata** | 1,3,5 | **7** |
| | **2.1** | Regular languages and regular expressions | | |
| | **2.2** | Finite Automata, Nondeterministic Finite Automata, Nondeterministic Finite Automata with $\epsilon$-transitions | | |
| | **2.3** | Kleene's theorem | | |
| | **2.4** | NFA to DFA Conversion | | |
| | **2.5** | Finite Automata with output (Moore and Mealy Machine) | | |
| **3** | **Title** | **Regular Languages** | 1,4 | **6** |
| | **3.1** | The pumping lemma for regular languages, Applications of the pumping lemma | | |
| | **3.2** | Closure properties for regular languages | | |
| | **3.3** | Equivalence and minimization of automata: Testing equivalence of states, Minimization of DFA's | | |
| **4** | **Title** | **Context-Free Grammars and Languages** | 1,5 | **5** |
| | **4.1** | Context free grammars: Definition of context free grammars, Derivations using a grammar, The language of a grammar, Sentential forms | | |
| | **4.2** | Parse trees: Constructing parse trees, From inferences to trees, From trees to derivations, From derivations to recursive inferences | | |
| | **4.3** | Ambiguity in grammars and languages: Ambiguous grammars, Removing ambiguity from grammars | | |
| **5** | **Title** | **Pushdown Automata** | 1,2 | **6** |
| | **5.1** | Definition of the pushdown automaton: The formal definition of pushdown automata, A graphical notation for PDA's, Instantaneous descriptions of a PDA | | |
| | **5.2** | The languages of a PDA: Acceptance by final state, Acceptance by empty stack, From empty stack to final state, From final state to empty stack | | |
| | **5.3** | Equivalence of PDA's and CFG's: From grammars to pushdown automata, From PDA's to Grammar | | |
| | **5.4** | Deterministic pushdown automata: Definition of a deterministic PDA, Regular languages and deterministic PDA's, DPDA's and context free languages | | |
| **6** | **Title** | **Properties of Context-Free Languages** | 1,2,3 | **5** |

| | | | | |
|---|---|---|---|---|
| | **6.1** | Eliminating useless symbols, Computing the generating and reachable symbols, Chomsky normal form, Greibach normal form | | |
| | **6.2** | The Pumping lemma for context free languages: Applications of the pumping lemma for CFL's | | |
| **7** | **Title** | **Introduction to Turing Machines** | 1,2, | **6** |
| | **7.1** | Turing machines: Formal definition of a Turing machine, Examples of Turing machines | | |
| | **7.2** | Halting Problem, Post Correspondence Problem (PCP) | | |
| | **7.3** | Variants of Turing machines: Multitape Turing Machines | | |
| | **7.4** | Church-Turing hypothesis | | |
| **8** | **Title** | **Recursively Enumerable Languages** | 3 | |
| | **8.1** | Recursively Enumerable and recursive | | **4** |
| | **8.2** | Enumerating a language | | |
| | **8.3** | Context sensitive languages and the Chomsky hierarchy | | |
| | **Self Study** | **Tractable and Intractable Problems:** Tractable and Possibly Intractable Problems: P and NP, Polynomial-Time Reductions and NP-Completeness, Cook's Theorem | 3 | **5*** |
| | | | **Total (*Not included)** | **42** |

**Text Books**

| Sr. No | Title | Edition | Authors | Publisher | Year |
|---|---|---|---|---|---|
| 1 | Introduction to Automata Theory, Languages, and Computation | Third | John E. Hopcroft, Rajeev Motwani, Jeffrey D. Ullman | Pearson | 2008 |
| 2 | Introduction to the Theory of computation | Third | Michael Sipser | Cengage | 2013 |

**Reference Books**

| Sr. No | Title | Edition | Authors | Publisher | Year |
|---|---|---|---|---|---|
| 3 | Introduction to Languages and the Theory of Computation | Fourth | John C. Martin | McGraw-Hill | 2010 |
| 4 | Elements of the Theory of Computation | Second | Harry R. Lewis, Christos H. Papadimitriou | Pearson | 2015 |
| 5 | Automata and Computability | -- | Dexter C. Kozen | Springer | 1997 |

# Department of Computer Engineering

| Course (Category) Code | Course Name | Teaching Scheme (Hrs/week) | | | | | Credits Assigned | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | L | T | P | O | E | L | T | P | Total |
| (PC) | Software Engineering | 3 | 0 | 2 | 5 | 10 | 3 | 0 | 1 | 4 |
| | | Examination Scheme | | | | | | | | |
| CE302 | | Component | ISE | | MSE | | ESE | | | Total |
| | | Theory | 75 | | 75 | | 150 | | | 300 |
| | | Laboratory | 50 | | -- | | 50 | | | 100 |

| | |
|---|---|
| **Pre-requisite Course Codes, if any.** | Object-oriented programming language -CS102, DBMS-IT/CS204 |
| **Course Objective:** To understand the best practices in software engineering and gain knowledge to analyze, design, implement and test software project. | |
| **Course Outcomes (CO): At *the End of the course students will be able to*** | |
| **CE302.1** | Analyze software requirements. |
| **CE302.2** | Apply UML models for a project. |
| **CE302.3** | Evaluate system architecture and develop detailed task schedule from the overall estimates and planning. |
| **CE302.4** | Illustrate different coding principles with unit test process. |
| **CE302.5** | Understand the need for DevOps. |

**CO-PO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CE302.1 | - | 3 | - | - | - | - | - | - | 2 | 2 | - | - |
| CE302.2 | - | 2 | | | 2 | - | - | - | 2 | 2 | - | - |
| CE302.3 | - | 3 | 2 | 1 | 2 | - | - | - | 2 | 2 | 2 | - |
| CE302.4 | - | | 3 | - | 2 | - | - | - | 2 | - | - | - |
| CE302.5 | - | 1 | 1 | - | - | - | - | - | - | - | - | 1 |

**CO-PEO/PSO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)**

| | PEO1 | PEO2 | PEO3 | PEO4 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|
| CE302.1 | 3 | | | | | | |
| CE302.2 | 3 | | 2 | | | | |
| CE302.3 | 3 | | 2 | | | 2 | |
| CE302.4 | 3 | | | | | 2 | |
| CE302.5 | 3 | 2 | | | | 2 | |

**BLOOM'S Levels Targeted (Pl. Tick appropriate)**

| Remember | Understand | Apply | Analyze | Evaluate ✓ | Create |
|---|---|---|---|---|---|
| | | | | | |

# Department of Computer Engineering

**Theory Component**

| Module No. | Unit No. | Topics | Ref. | Hrs. |
|---|---|---|---|---|
| **1** | | **Introduction** | | **06** |
| | **1.1** | Software Development Challenges, Software Scope, The Human Side of Software Development | 1,2 | |
| | **1.2** | Software Methodologies and Related Process Models with applications, Traditional Life Cycle Models, Waterfall, Incremental, Iterative models, Agile Software Engineering Process Models, SCRUM, Extreme Programming | 1,2 | |
| **2** | | **Requirements Management and Project Planning** | | **10** |
| | **2.1** | Requirements Development Methodology, Specifying Requirements, Eliciting Accurate Requirements, Documenting Business Requirements, SRS, Defining User Requirements, Validating Requirements, Achieving Requirements Traceability, Managing Changing Requirements, Agile Requirements Engineering | 1,2 | |
| | **2.2** | Scheduling, Work Breakdown Structure, Gantt Chart, Pert Chart, Critical Path, Earned Value Analysis, Schedule & Cost slippage, Estimation, Decomposition techniques, Empirical estimation models, Software Risk Management**:** Risk Identification, Risk Projection, Risk Refinement, RMMM Plan | 1,2 | |
| **3** | | **Software Analysis** | | **08** |
| | **3.1** | Difference between Structured & Object-Oriented analysis, Structured Analysis, Data Flow Diagrams | 4,5 | |
| | **3.2** | Object Oriented Analysis, Uses Case, Class diagram, Interaction diagrams, Activity diagram, State Chart diagram, Component & Deployment diagram | 4,5 | |
| **4** | | **Software Design & Development** | | **08** |
| | **4.1** | Software Architecture, Architectural and Pattern-Based Design, Model Driven Architectures | 1,2 | |
| | **4.2** | Software Development, Component Infrastructures, Refactoring, Test Driven Development (TDD) | 1,2 | |
| | **4.3** | DevOps, Continuous Integration, Continuous Deployment, System Provisioning and Configuration Management | 3 | |
| | **4.4** | Software Change Management, Change Control, Version Control | 1,2 | |
| **5** | | **Software Quality & Testing** | | **10** |
| | **5.1** | Software Quality Concepts, Quality Assurance, Quality Control, Formal Technical Reviews | 1,2 | |
| | **5.2** | Software Metrics, Product Metrics – McCall's Quality Factor, Metrics for Analysis Model and Design Model, Project Metrics, Process Metrics, Metrics for Source Code | 1,2 | |
| | **5.3** | Software Testing, Unit Testing, Integration Testing, System Testing | 1,2 | |

| | | | | |
|---|---|---|---|---|
| **6** | **Self Study** | Advance Topic in software Engineering | | **05*** |
| | | ○ Design Pattern | | |
| | | | **Total (*Not included)** | **42** |

**Laboratory Component, if any. (Minimum 10 Laboratory experiments are expected)**

| Sr. No | Title of the Experiment |
|---|---|
| **1** | Gather requirements and write a project proposal for case study.<br>Prepare SRS document. (Use IEEE template) |
| **2** | Design UML diagram -Use Case, Class diagram |
| **3** | Design UML diagram -Interaction diagrams |
| **4** | Design Data flow diagram (level 0 and1) for the case study. |
| **5** | Create work breakdown structure and schedule the activities |
| **6** | Develop Risk Mitigation, Monitoring and Management Plan for the case study. |
| **7** | Create versions of software using version control tool. |
| **8** | Implement any one Module from chosen case study. |
| **9** | Prepare test cases and perform Unit Testing (test scenario, test cases, test data) |
| **10** | Study on continuous Integration using DevOp |

**Text Books**

| Sr. No | Title | Edition | Authors | Publisher | Year |
|---|---|---|---|---|---|
| 1 | Software Engineering: A Practitioner's Approach | Ninth Edition | Roger S. Pressman and Bruce Maxim | McGraw-Hill | 2019 |
| 2 | Fundamentals of Software Engineering | Fifth Edition | Rajib Mall | PHI Learning | 2018 |

**Reference Books**

| Sr. No | Title | Edition | Authors | Publisher | Year |
|---|---|---|---|---|---|
| 3 | The DevOps Handbook: How to Create World-Class Agility, Reliability, and Security in Technology Organizations | -- | Gene Kin, Patrick Debois, John Willis, Jez Humble, and John Allspaw | IT Revolution Press | 2016 |
| 4 | UML for Java Programmers | -- | Robert C. Martin | Pearson | 2006 |
| 5 | UML Distilled: A Brief Guide to the Standard Object Modeling Language | Third Edition | Martin Fowler | Addition Wesley | 2003 |

# Department of Computer Engineering

| Course (Category) Code | Course Name | Teaching Scheme (Hrs/week) | | | | | Credits Assigned | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | L | T | P | O | E | L | T | P | Total |
| (PC) | Cryptography and System Security | 3 | 0 | 2 | 5 | 10 | 3 | 0 | 1 | 4 |
| | | Examination Scheme | | | | | | | | |
| | | Component | ISE | | MSE | | ESE | | | Total |
| CE303A | | Theory | 75 | | 75 | | 150 | | | 300 |
| | | Laboratory | 50 | | - | | 50 | | | 100 |

| | |
|---|---|
| **Pre-requisite Course Codes, if any.** | CS207 |
| **Course Objective:** To apply and analyze different cryptography and system security protocols/techniques | |
| **Course Outcomes (CO): At *the End of the course students will be able to*** | |
| **CE303A.1** | Describe the different types of the cryptographic algorithms to secure information. |
| **CE303A.2** | Apply different cryptographic techniques to solve security-related problems. |
| **CE303A.3** | Create a message digest from data to authenticate authorized user |
| **CE303A.4** | Use system security practices |

**CO-PO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)**

| | PO 1 | PO 2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CE303A.1 | 3 | - | - | - | - | - | - | - | - | - | - | - |
| CE303A.2 | 3 | 3 | - | - | - | - | - | - | - | - | - | - |
| CE303A.3 | - | 3 | - | - | - | - | - | - | - | - | - | - |
| CE303A.4 | - | 3 | 3 | 3 | 2 | - | - | - | - | - | - | - |

**CO-PEO/PSO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)**

| | PEO1 | PEO2 | PEO3 | PEO4 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|
| CE303A.1 | - | - | - | - | - | - | - |
| CE303A.2 | - | - | - | - | - | - | - |
| CE303A.3 | - | - | - | - | - | - | - |
| CE303A.4 | - | - | - | - | - | - | - |

**BLOOM'S Levels Targeted (Pl. Tick appropriate)**

| Remember | Understand | Apply | Analyze | Evaluate | Create ✓ |
|---|---|---|---|---|---|

# Department of Computer Engineering

**Theory Component**

| Module No. | Unit No. | Topics | Ref. | Hrs. |
|---|---|---|---|---|
| 1 | Title | **Introduction to Security and Cryptography** | | 10 |
| | 1.1 | Introduction Security Attacks, Security Goals, Computer criminals, Methods of defense, Security Services, Security Mechanisms | 1,4 | |
| | 1.2 | Basics of Cryptography Symmetric Cipher Model, Substitution Techniques, Transportation Techniques, Other Cipher Properties-Confusion, Diffusion, Block and Stream Ciphers. | 1,2,3 | |
| 2 | Title | **Secret and Public Key Cryptography Techniques** | | 10 |
| | 2.1 | Secret Key Cryptography Data Encryption Standard (DES), Strength of DES, Block Cipher Design Principles and Modes of Operations, Triple DES, AES | 1,2,3 | |
| | 2.2 | Public Key Cryptography Principles of Public Key Cryptosystems, RSA Algorithm, Diffie-Hellman Key Exchange | 1,2,3 | |
| 3 | Title | **Hashing Algorithms and Authentication Protocols** | | 12 |
| | 3.1 | Cryptographic Hash Functions Applications of Cryptographic Hash Functions, Secure Hash Algorithm, Message Authentication Codes – Message Authentication Requirements and Functions, HMAC, Digital signatures, Digital Signature Schemes, Digital Signature Standards. | 1,2,3 | |
| | 3.2 | Authentication Protocols, Kerberos, Key Management and Distribution, X.509 Directory, Authentication service, Public Key Infrastructure, Electronic Mail Security: Pretty Good Privacy, S/MIME, Domain Key Identified Mail (DKIM). | 1,2,3 | |
| 4 | Title | **Security** | | 10 |
| | 4.1 | IDS and Firewalls:<br>Intrusion Detection System, Types of IDS, Firewalls Characteristics, Types of Firewalls, Placement of Firewalls, Firewall Configuration, | 1,2,3,4 | |
| | 4.2 | Internet Protocol Security (IPSec) Architecture, Authentication Header, Encapsulating Security Payload, Combining security Associations, Internet Key Exchange, | 1,2,3,4 | |
| | 4.3 | Web Security Considerations, Secure Sockets Layer and Transport Layer Security, Electronic Payment.<br>Non-cryptographic protocol Vulnerabilities, DoS, DDoS, Session Hijacking and Spoofing, Software Vulnerabilities-Phishing, Buffer Overflow, Format String Attacks, SQL Injection. | 1,2,3,4 | |
| | Self-Study | International Data Encryption algorithm (IDEA) algorithm, Blowfish algorithm, Elliptic Curve Cryptography, DMZ Architecture, and QR Code generation and scanning, Honeypots, DNSSEC | | *8 |

| | |
|---|---|
| **Total (* Not included)** | **42** |

**Laboratory Component, if any. (Minimum 10 Laboratory experiments are expected)**

| Sr. No | Title of the Experiment |
|---|---|
| **1** | Implement different substitution techniques. |
| **2** | Implement different transportation techniques. |
| **3** | Implementation of RSA algorithm. |
| **4** | Implementation of Diffie-Hellman key exchange algorithm. |
| **5** | Generate and calculate Hashes and checksum files. |
| **6** | Implement Pretty Good Privacy (PGP) security method. |
| **7** | Implement SNORT Intrusion Detection System. |
| **8** | Configure Firewall rules using IP tables. |
| **9** | Implement SQL Injection. |
| **10** | Implement Session Hijacking attack. |

**Text Books**

| Sr. No | Title | Edition | Authors | Publisher | Year |
|---|---|---|---|---|---|
| 1 | Cryptography and Network Security: Principles and Practice | Fifth Edition | William Stallings | Pearson | 2011 |
| 2 | Network Security and Cryptography | Second Edition | Bernard Menezes | Cengage Learning | 2011 |
| 3 | Cryptography and Network Security | First Edition | Behrouz A Fourouzan | TMH | 2007 |
| 4 | Security in Computing | Fifth Edition | Charles P. Pfleeger | Pearson Education | 2015 |

**Reference Books**

| Sr. No | Title | Edition | Authors | Publisher | Year |
|---|---|---|---|---|---|
| 1. | Cryptography and Network | Second Edition | Behrouz A Fourouzan, Debdeep Mukhopadhyay | TMH | 2010 |
| 2. | Computer Security Art and Science | First Edition | Matt Bishop | Addison-Wesley | 2002 |

## Department of Computer Engineering

| Course (Category) Code | Course Name | Teaching Scheme (Hrs/week) | | | | | Credits Assigned | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | L | T | P | O | E | L | T | P | Total |
| (PC) | Artificial Intelligence and Machine Learning | 3 | 0 | 2 | 5 | 10 | 3 | 0 | 1 | 4 |
| CE303B | | Examination Scheme | | | | | | | | |
| | | Component | ISE | | MSE | | ESE | | | Total |
| | | Theory | 75 | | 75 | | 150 | | | 300 |
| | | Laboratory | 50 | | -- | | 50 | | | 100 |

| | |
|---|---|
| **Pre-requisite Course Codes, if any.** | CS202/IT202: Data Structures, MA203: Probability and Statistics |
| **Course Objective:** This course covers the fundamental concepts of Artificial Intelligence and machine learning. | |
| **Course Outcomes (CO):** ***At the End of the course students will be able to*** | |
| **CE303B.1** | Understand AI building blocks presented in intelligent agents |
| **CE303B.2** | Solve the problems using suitable searching methods. |
| **CE303B.3** | Solve the problems using suitable reasoning and knowledge representation methods. |
| **CE303B.4** | Apply suitable machine learning technique for a given problem |
| **CE303B.5** | Design an intelligent system using different AIML techniques for real life problems. |

**CO-PO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CE303B.1 | 2 | 3 | - | - | 2 | - | - | - | - | - | 2 | - |
| CE303B.2 | 2 | 3 | 2 | 2 | - | - | - | - | - | - | 2 | - |
| CE303B.3 | 2 | 3 | 2 | 2 | - | - | - | - | - | 1 | 2 | - |
| CE303B.4 | 2 | 3 | - | - | 2 | - | - | - | - | 2 | 2 | - |
| CE303B.5 | 2 | 3 | 2 | 2 | 2 | - | - | - | - | 2 | 2 | 2 |

**CO-PEO/PSO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)**

| | PEO1 | PEO2 | PEO3 | PEO4 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|
| CE303B.1 | - | - | - | - | - | - | - |
| CE303B.2 | - | - | - | - | - | - | - |
| CE303B.3 | - | - | - | - | - | - | - |
| CE303B.4 | 1 | 1 | 1 | - | - | - | - |
| CE303B.5 | 2 | 2 | 2 | - | | 2 | - |

**BLOOM'S Levels Targeted (Pl. Tick appropriate)**

| Remember | Understand | Apply | Analyze | Evaluate✓ | Create |
|---|---|---|---|---|---|
| | | | | | |

# Department of Computer Engineering

**Theory Component**

| Module No. | Unit No. | Topics | Ref. | Hrs. |
|---|---|---|---|---|
| 1 | Title | **Introduction to Artificial Intelligence** | 1 | 04 |
| | 1.1 | Definition of AI, History and Future of AI, Problem solving Approach to Typical AI problem. | | |
| | 1.2 | **Intelligent Agents and Environment** What is an Intelligent Systems, Types of Agents, structure of agent. | | |
| | 1.3 | Environments and Its Properties, PEAS Representation for an Agent | | |
| 2 | Title | **Problem solving by Searching** | 1 | 10 |
| | 2.1 | Searching: characteristics and issues in design of search programs | | |
| | 2.2 | **Uninformed search techniques:** State Space Search, Depth First Iterative Deepening | | |
| | 2.3 | **Informed Search methods:** Heuristic Search, Hill Climbing. | | |
| | 2.4 | **Adversarial Search:** Game playing, Min-Max Search, Alpha-Beta Pruning | | |
| 3 | Title | **Knowledge Representation and Reasoning** | | 08 |
| | 3.1 | Reasoning: Representing and Reasoning with Uncertain Knowledge | | |
| | 3.2 | Knowledge representation: A Knowledge-Based Agent, The Wumpus World. | | |
| | 3.3 | Propositional Logic, First-order predicate logic, Forward and Backward Chaining | | |
| 4 | Title | **Introduction to Machine Learning** | | 12 |
| | 4.1 | Introduction: What is Machine Learning, History and overview of machine learning, | 2,3 | |
| | 4.2 | Types of Machine Learning – Supervised, Unsupervised Semi-Supervised Learning and Reinforcement Learning, Design a Learning System, The curse of dimensionality | | |
| | 4.3 | Evaluating a hypothesis: Model selection, training/ validation/testing procedures, diagnosing bias versus variance and vice versa, regularization and bias/variance, learning curves | 2,3 | |
| 5 | Title | **Linear Models for Regression** | | **8** |
| | 5.1 | Two Simple Approaches to Prediction: Least Squares and Nearest Neighbors | 4 | |
| | 5.2 | Linear Regression, Multivariate Regression, Subset Selection, Shrinkage Methods | | |
| 6 | **Self-Study** | **Linear model for Classification**: Logistic Regression, Linear Discriminant Analysis, Perceptron, Support Vector Machines, PCA | 3,4 | **5*** |
| | | | **Total (* Not included)** | **42** |

# Department of Computer Engineering

**Laboratory Component, if any. (Minimum 10 Laboratory experiments are expected)**

| Sr. No | Title of the Experiment |
|---|---|
| **1** | Implement an Intelligent agent. |
| **2** | Implement a given problem using the searching technique. |
| **3** | Implement a given problem using knowledge representation and reasoning rules |
| **4** | To design and implement an intelligent system, incorporating the matching algorithm and the rule language.<br>1. It should provide a fact base updating function.<br>2. It should provide a function that checks the rules' LHS and return which rules were matched.<br>3. It should support firing RHS according to matches.<br>Using SWISH Prolog or Java or Python or any other open-source tool |
| **5** | Implement supervised learning algorithms. |
| **6** | Implement unsupervised learning algorithms. |
| **7** | Implement the regression model |
| **8** | Minor project covering the concepts of AIML on the real life problem statements. |

**Text Books**

| Sr. No | Title | Edition | Authors | Publisher | Year |
|---|---|---|---|---|---|
| 1 | Artificial Intelligence: A Modern Approach | Third Edition | Stuart Russell and Peter Norvig | Prentice-Hall | 2009 |
| 2 | Machine Learning A Probabilistic Perspective | First Edition | Kevin P. Murphy | Massachusetts Institute of Technology | 2012 |
| 3 | Machine Learning, | First Edition | Tom. M. Mitchell | McGraw Hill International Edition | 1997 |
| 4 | The Elements of Statistical Learning | Second Edition | Trevor Hastie Robert Tibshirani Jerome Friedman | Springer | 2009 |

**Reference Books**

| Sr. No | Title | Edition | Authors | Publisher | Year |
|---|---|---|---|---|---|
| 5 | Artificial Intelligence: Making a System Intelligent | First Edition | Nilakshi Jain | Wiley Publication | 2019 |
| 6 | Pattern Recognition and Machine Learning, | First Edition | C. M. Bishop | Springer | 2013 |

# Department of Computer Engineering

| Course (Category) Code | Course Name | Teaching Scheme (Hrs/week) | | | | | Credits Assigned | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | L | T | P | O | E | L | T | P | Total |
| (PC) | Distributed Computing | 3 | 0 | 2 | 5 | 10 | 3 | 0 | 1 | 4 |
| | | Examination Scheme | | | | | | | | |
| CE304 | | Component | ISE | | MSE | | ESE | | | Total |
| | | Theory | 75 | | 75 | | 150 | | | 300 |
| | | Laboratory | 50 | | -- | | 50 | | | 100 |

| | |
|---|---|
| **Pre-requisite Course Codes, if any.** | Operating Systems, Computer Networks and Communications |
| **Course Objective:** To familiarize students with the fundamental concepts, techniques and design of Distributed Systems and use of distributed computing applications domains. | |
| **Course Outcomes (CO): At *the End of the course students will be able to*** | |
| **CE304.1** | Understand the principles and desired properties of distributed systems. |
| **CE304.2** | Apply the various communication techniques for distributed communication. |
| **CE304.3** | Apply the concepts of process, naming, consistency, replication and faults tolerance in distributed environment. |
| **CE304.4** | Apply the algorithms such as clock synchronization, election, and mutual exclusion in distributed applications. |
| **CE304.5** | Identify the challenges in developing distributed applications. |

**CO-PO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CE304.1 | 2 | 1 | - | - | - | - | - | - | - | - | - | 2 |
| CE304.2 | 2 | 2 | 2 | 1 | - | - | - | 2 | 2 | 1 | - | 2 |
| CE304.3 | 2 | 2 | 2 | 1 | - | - | - | 2 | 2 | 1 | - | 2 |
| CE304.4 | 2 | 2 | 2 | 1 | - | - | - | 2 | 2 | 1 | - | 2 |
| CE304.5 | 2 | 2 | 2 | 1 | - | - | - | 1 | 2 | 1 | - | 2 |

**CO-PEO/PSO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)**

| | PEO1 | PEO2 | PEO3 | PSO1 | PSO2 |
|---|---|---|---|---|---|
| CE304.1 | 1 | 1 | 1 | - | |
| CE304.2 | 1 | 1 | 1 | - | 1 |
| CE304.3 | 1 | 1 | 1 | - | 1 |
| CE304.4 | 1 | 1 | 1 | - | 1 |
| CE304.5 | 1 | 1 | 1 | - | 1 |

# Department of Computer Engineering

**BLOOM'S Levels Targeted (Pl. Tick appropriate)**

| Remember | Understand | Apply | Analyze✓ | Evaluate | Create |
|---|---|---|---|---|---|

**Theory Component**

| Module No. | Unit No. | Topics | Ref. | Hrs. |
|---|---|---|---|---|
| 1 | **Title** | **Introduction to Distributed Systems** | | |
| | 1.1 | Definition, Type, Goals, Distributed Computing Models, Issues in Distributed Systems. | 1,2 | **08** |
| | 1.2 | Hardware Concepts, Software Concepts, The Client-Server Model, Positioning Middleware, Models of Middleware, Services offered by Middleware, models of Distributed Algorithms and some fundamental problems. | 1,2 | |
| **2** | **Title** | **Communication In Distributed Systems** | | **12** |
| | 2.1 | Introduction to Message Passing, Desirable Features of a Good Message-Passing System, Issues in IPC by Message Passing, Synchronization, Buffering, Multi-datagram Messages, Group Communication. | 1,2 | |
| | 2.2 | Remote Procedure Call (RPC): Basic RPC Operations, Parameter Passing, Extended RPC Models.<br>Remote Object Invocation: Distributed Objects, Binding a Client to an Object, Static Vs Dynamic RMI<br>Message Oriented Communication: Persistence and synchronicity in communication, Message Oriented Transient and Persistent Communications | 1,2 | |
| **3** | **Title** | **Process in Distributed Systems** | | **6** |
| | 3.1 | Introduction to Threads, Threads in Distributed Systems, Clients, Server | 1,2 | |
| | 3.2 | Code Migration: Approaches to Code Migration, Models, Migration and Local Resources, Migration in Heterogeneous Systems | 1,2 | |
| **4** | **Title** | **Synchronization in Distributed Systems** | | **10** |
| | 4.1 | Clock Synchronization: Physical Clocks, Global Positioning System, Clock Synchronization Algorithms;<br>Logical Clocks: Lampert's Logical Clocks, Vector Clocks | 1,2 | |
| | 4.2 | Election Algorithms: Bully and Ring; Mutual Exclusion: Centralized Algorithm, Decentralized Algorithm, Distributed Algorithm, Token Ring Algorithm, Comparison of Algorithms;<br>Load Balancing: Goals, Types, Strategies. | 1,2 | |
| **5** | **Title** | **Consistency and Replication** | | **6** |

| | | | | |
|---|---|---|---|---|
| | 5.1 | Reasons for Replication, Object Replication, Replication as Scaling Technique Data Replication in Distributed Systems, Goals, Types, Schemes, | 1 | |
| | 5.2 | Data-Centric Consistency Models, Client Centric Consistency Models Continuous Consistency, Consistent Ordering of Operations | 1 | |
| **6** | **Self Study** | Naming Entities, Locating Mobile Entities, Distribution Protocols, Consistency Protocols, Faults Tolerance: Process Resilience, Distributed Commit, Recovery | 1,2 | **8*** |
| | | | **Total (* Not included)** | **42** |

**Laboratory Component**

| Sr. No | Title of the Experiments |
|---|---|
| 1 | Implementation of Client Server Communication using RPC/RMI. |
| 2 | Implementation of Clock Synchronization (logical/physical). |
| 3 | Implementation of Election algorithm. |
| 4 | Implementation of Mutual Exclusion algorithm. |
| 5 | Implementation of Client Server based program to check data consistency. |
| 6 | Implement Load Balancing Algorithms |
| 7 | Mini Project |

**Text Books:**

| Sr. No | Title | Edition | Authors | Publisher | Year |
|---|---|---|---|---|---|
| 1 | Distributed Systems–Principles and Paradigms. | First Edition | Andrew S. Tanenbaum, Maarten Van Steen | PHI | 2004 |
| 2 | Distributed Operating Systems Concepts and Design | Second Edition | P. K. Sinha | PHI | 2010 |

**Reference Books:**

| Sr. No | Title | Edition | Authors | Publisher | Year |
|---|---|---|---|---|---|
| 1 | Distributed Systems – Concept and Design | Fourth Edition | George Coulouris, Jean Dollimore, Tim Kindberg, & Gordon Blair | Pearson | 2010 |
| 2 | Distributed VOD Systems | First Edition | Sudhir D. & Bandu B.M | Research India Publication | 2011 |

# Department of Computer Engineering

| Course (Category) Code | Course Name | Teaching Scheme (Hrs/week) | | | | | Credits Assigned | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | L | T | P | O | E | L | T | P | Total |
| SBC | Cloud and Internet Technology Lab | 1 | 0 | 2 | 5 | 8 | 1 | 0 | 1 | 2 |
| | | Examination Scheme | | | | | | | | |
| CE305 | | Component | ISE | | MSE | | ESE | | Total | |
| | | Theory | -- | | -- | | -- | | -- | |
| | | Laboratory | 100 | | -- | | 100 | | 200 | |

| | |
|---|---|
| **Pre-requisite Course Codes, if any.** | CS208/IT208 Mini Project |
| **Course Objective: :** To impart a knowledge of different Internet Technologies. | |
| **Course Outcomes (CO): At *the End of the course students will be able to*** | |
| **CE305.1** | Develop a sophisticated web UX |
| **CE305.2** | Create, integrate and test REST based web services |
| **CE305.3** | Design secured web application/ web services |
| **CE305.4** | Demonstrate behavior of web crawlers and testing of web application |

**CO-PO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CE305.1 | - | - | 1 | | 3 | - | - | - | - | - | - | - |
| CE305.2 | - | - | - | 2 | 3 | - | - | - | - | - | - | - |
| CE305.3 | - | - | - | 1 | 3 | - | - | - | - | - | - | - |
| CE305.4 | - | - | - | 1 | 3 | - | - | - | - | - | - | - |

**CO-PEO/PSO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)**

| | PEO1 | PEO2 | PEO3 | PEO4 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|
| CE305.1 | - | - | - | - | - | 3 | |
| CE305.2 | - | - | - | - | - | 3 | |
| CE305.3 | - | - | - | - | - | 3 | |
| CE305.4 | - | - | - | - | - | 3 | |

**BLOOM'S Levels Targeted (Pl. Tick appropriate)**

| Remember | Understand | Apply | Analyze | Evaluate | Create ✓ |
|---|---|---|---|---|---|
| | | | | | |

# Department of Computer Engineering

**Theory Component**

| Module No. | Unit No. | Topics | Ref. | Hrs. |
|---|---|---|---|---|
| **1** | | **Designing UI** | | |
| | **1.1** | Fundamentals of UX Design, Defining UX Solutions, Design Communication and Visualizing Ideas | 1 | **2** |
| **2** | | **Web content management system** | | **1** |
| | **2.1** | Introduction to Web CMS, different types of Web CMS | 2 | |
| **3** | | **Web services** | | **2** |
| | **3.1** | Introduction to web service, REST architecture | 3 | |
| **4** | | **Web mashups** | | **1** |
| | **4.1** | Introduction to web mashups, server side mashups, client side mashups | 2 | |
| **5** | | **Secured Web application** | | **2** |
| | **5.1** | Introduction to Web Tokens, Auth2.0, OAuth, Access token | 2 | |
| **6** | | **Integration of web services** | | **2** |
| | **6.1** | Introduction to Mule ESB, Introduction to Anypoint studio, Integrating Web Services using Any point studio | 4 | |
| **7** | | **Web crawlers** | | **2** |
| | **7.1** | Introduction to web crawler, role of crawler in the internet, concept of page ranking | 3 | |
| **8** | | **Testing web applications** | | **2** |
| | **8.1** | Introduction to different types of testing, manual testing, automated testing, performance testing and functional testing, open-source tools used for testing | 2 | |
| | | **Total** | | **14** |

**Laboratory Component, if any. (Minimum 10 Laboratory experiments are expected)**

| Sr. No | Title of the Experiment |
|---|---|
| **1** | Design web pages using HTML, CSS and JavaScript |
| **2** | Design UX for a given problem definition by using open source UX tools |
| **3** | Create a website using web CMS (Node Js/Angular Js/React Js/Flask/Django/WordPress/Joomla etc.) |
| **4** | Create a Restful webservice to demonstrate different HTTP methods |
| **5** | Testing of restful web service using Postman/ARC |
| **6** | Create a web mashup of web services using open-source framework |
| **7** | Design secured Web application using web token |
| **8** | Integration of web services using open-source integration tools like MuleSoft |
| **9** | Demonstrate the behavior of Web Crawlers/ spiders (use XPATH, CSS PATH), extract information and store it in the database. |
| **10** | Test the web application using open-source testing tools like Selenium, Test runner and Junit |

**Text Books**

| Sr. No | Title | Edition | Authors | Publisher | Year |
|---|---|---|---|---|---|
| 1 | Sketching the User experiences | Second edition | Bill Buxton | Diane Cerra | 2010 |
| 2 | Rich Internet Application AJAX and Beyond | Third edition | Dana Moore, Raymond Budd, Edward Benson | WROX Publisher | 2017 |
| 3 | Web Technology | Second Edition | Srinivasan | Pearson | 2014 |
| 4 | API Recipes with Mulesoft(r) Anypoint Platform | First Edition | WHISHWORKS Editorial Board | White falcon | 2017 |

**Reference Books**

| Sr. No | Title | Edition | Authors | Publisher | Year |
|---|---|---|---|---|---|
| 5 | Internet Technology And Web Design | First Edition | R. K. JAIN | Khanna Book Publishing Company | 2015 |
| 6 | Understanding the Internet: A Clear Guide to Internet Technologies | First Edition | Keith Sutherland | A Butterworth-Heinemann Title | 2016 |
| 7 | RESTful Web APIs: Services for a Changing World | Third edition | Leonard Richardson, Mike Amundsen, Sam Ruby | O'REILLY | 2013 |