# B.Tech - Information Technology

# Curriculum and Syllabus

| UNIVERSITY CORE – 70 CREDITS | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Course Code | Course Title | Course Type | L | T | P | J | C | Category | Pre-requisite | Co-requisite | Anti-requisite | Course Equivalence |
| CHY1002 | Environmental Sciences | Theory | 3 | 0 | 0 | 0 | 3 | NIL | NONE | | | NIL |
| CHY1701 | Engineering Chemistry | Embedded - Theory & Lab | 3 | 0 | 2 | 0 | 4 | NIL | | | CHY1001 | NIL |
| CSE1001 | Problem Solving and Programming | Lab | 0 | 0 | 6 | 0 | 3 | NIL | NONE | | | NIL |
| CSE1002 | Problem Solving and Object Oriented Programming | Lab | 0 | 0 | 6 | 0 | 3 | NIL | NONE | | | NIL |
| ENG1011 | English for Engineers | Lab | 0 | 0 | 4 | 0 | 2 | NIL | NONE | | | NIL |
| HUM1021 | Ethics and Values | Theory | 2 | 0 | 0 | 0 | 2 | NIL | NONE | | | NIL |
| ITE3099 | Industrial Internship | Project | 0 | 0 | 0 | 0 | 2 | NIL | | | | NIL |
| ITE3999 | Technical Answers for Real World Problems (TARP) | Embedded - Theory & Project | 1 | 0 | 0 | 8 | 3 | NIL | PHY1999 | | | NIL |
| ITE4098 | Comprehensive Examination | Project | 0 | 0 | 0 | 0 | 2 | NIL | | | | NIL |
| ITE4099 | Capstone Project | Project | 0 | 0 | 0 | 0 | 20 | NIL | | | | NIL |
| MAT1011 | Calculus for Engineers | Embedded - Theory & Lab | 3 | 0 | 2 | 0 | 4 | NIL | NONE | | | NIL |
| MAT2001 | Statistics for Engineers | Embedded - Theory & Lab | 2 | 1 | 2 | 0 | 4 | NIL | MAT1011 | | | NIL |
| MGT1022 | Lean Start-up Management | Embedded - Theory & Project | 1 | 0 | 0 | 4 | 2 | NIL | | | | NIL |
| PHY1701 | Engineering Physics | Embedded - Theory & Lab | 3 | 0 | 2 | 0 | 4 | NIL | NONE | | PHY1001 | NIL |
| PHY1999 | Introduction to Innovative Projects | Embedded - Theory & Project | 1 | 0 | 0 | 4 | 2 | NIL | | | | NIL |
| EXC4097 | Co-Extra Curricular Basket | Basket | 0 | 0 | 0 | 0 | 2 | NIL | | | | NIL |
| FLC4097 | Foreign Language Course Basket | Basket | 0 | 0 | 0 | 0 | 2 | NIL | | | | NIL |
| STS4097 | Soft Skills | Basket | 0 | 0 | 0 | 0 | 6 | NIL | | | | NIL |

| PROGRAMME CORE – 51 CREDTIS | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Course Code | Course Title | Course Type | L | T | P | J | C | Category | Prerequisite | Co-requisite | Anti-requisite | Course Equivalence |
| EEE1001 | Basic Electrical and Electronics Engineering | Embedded - Theory & Lab | 2 | 0 | 2 | 0 | 3 | NIL | NONE | | | NIL |
| ITE1001 | Digital Logic and Microprocessor | Embedded - Theory & Lab | 3 | 0 | 2 | 0 | 4 | NIL | NONE | | | NIL |
| ITE1002 | Web Technologies | Embedded - Theory & Lab | 2 | 0 | 2 | 0 | 3 | NIL | CSE1001 | | | NIL |
| ITE1003 | Database Management Systems | Embedded - Theory, Lab & Project | 2 | 0 | 2 | 4 | 4 | NIL | CSE1001 | | | NIL |
| ITE1004 | Data Structures and Algorithms | Embedded - Theory & Lab | 3 | 0 | 2 | 0 | 4 | NIL | NONE | | | NIL |
| ITE1005 | Software Engineering-Principles and Practices | Theory | 3 | 0 | 0 | 0 | 3 | NIL | CSE1001 | | | NIL |
| ITE1006 | Theory of Computation | Theory | 3 | 0 | 0 | 0 | 3 | NIL | MAT1014 | | | NIL |
| ITE2001 | Computer Architecture and Organization | Theory | 3 | 0 | 0 | 0 | 3 | NIL | ITE1001 | | | NIL |
| ITE2002 | Operating Systems | Embedded - Theory & Lab | 3 | 0 | 2 | 0 | 4 | NIL | ITE1004 | | | NIL |
| ITE3001 | Data Communication and Computer Networks | Embedded - Theory & Lab | 3 | 0 | 2 | 0 | 4 | NIL | ITE1004 | | | NIL |
| ITE4001 | Network and Information Security | Embedded - Theory & Project | 3 | 0 | 0 | 4 | 4 | NIL | ITE3001 | | | NIL |
| MAT1014 | Discrete Mathematics and Graph Theory | Theory | 3 | 1 | 0 | 0 | 4 | NIL | NONE | | | NIL |
| MAT2002 | Applications of Differential and Difference Equations | Embedded - Theory & Lab | 3 | 0 | 2 | 0 | 4 | NIL | MAT1011 | | | NIL |
| MAT3004 | Applied Linear Algebra | Theory | 3 | 1 | 0 | 0 | 4 | NIL | MAT2002 | | | NIL |

| PROGRAMME ELECTIVE – 47 CREDITS | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Course Code | Course Title | Course Type | L | T | P | J | C | Category | Pre-requisite | Co-requisite | Anti-requisite | Course Equivalence |
| ITE1007 | Object Oriented Analysis and Design | Embedded - Theory & Project | 3 | 0 | 0 | 4 | 4 | NIL | CSE1002 | | | NIL |
| ITE1008 | Open Source programming | Embedded - Theory & Project | 3 | 0 | 0 | 4 | 4 | NIL | CSE1001 | | | NIL |
| ITE1010 | Digital Image Processing | Embedded - Theory & Project | 3 | 0 | 0 | 4 | 4 | NIL | MAT3004 | | | NIL |
| ITE1011 | Computer Graphics | Embedded - Theory & Project | 3 | 0 | 0 | 4 | 4 | NIL | MAT3004 | | | NIL |
| ITE1014 | Human Computer Interaction | Embedded - Theory & Project | 3 | 0 | 0 | 4 | 4 | NIL | EEE1001 | | | NIL |
| ITE1015 | Soft Computing | Embedded - Theory & Project | 3 | 0 | 0 | 4 | 4 | NIL | MAT2001 | | | NIL |
| ITE1016 | Mobile Application Development | Embedded - Theory & Project | 3 | 0 | 0 | 4 | 4 | NIL | CSE1001 | | | NIL |
| ITE1017 | Transformation Techniques | Theory | 3 | 0 | 0 | 0 | 3 | NIL | MAT2002 | | | NIL |
| ITE2003 | Principles and Practices of Communication System | Embedded - Theory & Project | 3 | 0 | 0 | 4 | 4 | NIL | ITE1001 | | | NIL |
| ITE2004 | Software Testing | Embedded - Theory & Project | 3 | 0 | 0 | 4 | 4 | NIL | ITE1005 | | | NIL |
| ITE2005 | Advanced Java Programming | Embedded - Theory & Lab | 3 | 0 | 2 | 0 | 4 | NIL | ITE1002 | | | NIL |
| ITE2006 | Data Mining Techniques | Embedded - Theory & Project | 3 | 0 | 0 | 4 | 4 | NIL | ITE1003 | | | NIL |
| ITE2009 | Storage Technologies | Embedded - Theory & Project | 3 | 0 | 0 | 4 | 4 | NIL | ITE1003 | | | NIL |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ITE2010 | Artificial Intelligence | Embedded - Theory & Project | 3 | 0 | 0 | 4 | 4 | NIL | ITE1006 | | | NIL |
| ITE2011 | Machine Learning | Embedded - Theory & Project | 3 | 0 | 0 | 4 | 4 | NIL | ITE1015 | | | NIL |
| ITE2012 | .Net Programming | Embedded - Theory & Lab | 3 | 0 | 2 | 0 | 4 | NIL | ITE1002 | | | NIL |
| ITE2013 | Big Data Analytics | Embedded - Theory & Project | 3 | 0 | 0 | 4 | 4 | NIL | ITE1003 | | | NIL |
| ITE2014 | Software Project Management | Theory | 2 | 0 | 0 | 0 | 2 | NIL | ITE1005 | | | NIL |
| ITE2015 | Information System Audit | Theory | 2 | 0 | 0 | 0 | 2 | NIL | ITE1005 | | | NIL |
| ITE3002 | Embedded Systems | Embedded - Theory & Lab | 3 | 0 | 2 | 0 | 4 | NIL | ITE2001 | | | NIL |
| ITE3003 | Parallel Processing | Embedded - Theory & Project | 3 | 0 | 0 | 4 | 4 | NIL | ITE2001 | | | NIL |
| ITE3004 | Distributed Systems | Embedded - Theory & Project | 3 | 0 | 0 | 4 | 4 | NIL | ITE2001 | | | NIL |
| ITE3005 | Information Coding Theory | Embedded - Theory & Project | 3 | 0 | 0 | 4 | 4 | NIL | ITE2003 | | | NIL |
| ITE3007 | Cloud Computing and Virtualization | Embedded - Theory & Project | 3 | 0 | 0 | 4 | 4 | NIL | ITE2001 | | | NIL |
| ITE3008 | Information Retrieval | Embedded - Theory & Project | 3 | 0 | 0 | 4 | 4 | NIL | ITE2006 | | | NIL |
| ITE4002 | Network Management Systems | Embedded - Theory & Project | 3 | 0 | 0 | 4 | 4 | NIL | ITE3001 | | | NIL |
| ITE4003 | Internet of Things | Embedded - Theory & Project | 3 | 0 | 0 | 4 | 4 | NIL | ITE3001 | | | NIL |
| ITE4004 | Wireless Mobile Networking | Embedded - Theory & Project | 3 | 0 | 0 | 4 | 4 | NIL | ITE3001 | | | NIL |
| ITE4010 | Network Programming, Protocols and | Embedded - Theory | 3 | 0 | 0 | 4 | 4 | NIL | ITE3001 | | | NIL |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Standards | &Project | | | | | | | | | | |
| MAT3005 | Applied Numerical Methods | Theory | 3 | 1 | 0 | 0 | 4 | NIL | MAT2002 | | | NIL |

| UNIVERSITY ELECTIVE | | | | |
|---|---|---|---|---|
| **Course** | **L** | **T** | **P** | **C** |
| **University Elective-I** | - | - | - | 3 |
| **University Elective-II** | - | - | - | 3 |
| **University Elective-III** | - | - | - | 3 |
| **University Elective-IV** | - | - | - | 3 |
| **Total** | - | - | - | 12 |

| BREAKUP OF COURSES | | |
|---|---|---|
| **Sl.No.** | **Category** | **Credits** |
| **1** | University Core | **70** |
| **2** | University Elective | 12 |
| **3** | Programme Core | 51 |
| **4** | Programme Elective | **47** |
| **Recommended Total Number of Credits** | | 180 |
| **Minimum Total Number of Credits** (As per Acad. Council) | | 180 |

| **Category** | **No. of Credits** | **Credit distribution (%)** |
|---|---|---|
| **Engineering** | 127 | 70.5 |
| **Humanities** | 14 | 7.7 |
| **Management** | 14 | 7.7 |
| **Sciences** | 25 | 14.1 |
| **Total** | 180 | 100 |

| Course code | Environmental Sciences | L | T | P | J | C |
|---|---|---|---|---|---|---|
| CHY1002 | | 3 | 0 | 0 | 0 | 3 |
| Pre-requisite | Chemistry of 12th standard or equivalent | Syllabus version | | | | |
| | | 1.1 | | | | |

**Course Objectives:**

1. To make students understand and appreciate the unity of life in all its forms, the implications of life style on the environment.
2. To understand the various causes for environmentaldegradation.
3. To understand individuals contribution in the environmentalpollution.
4. To understand the impact of pollution at the global level and also in the local environment.

**Expected Course Outcome:**

Students will be able to

1. Understand the need foreco-balance.
2. Acquire basic knowledge about global climate change with a particular reference to the Indiancontext.
3. Find ways to protect the environment and play pro-activeroles

**Student Learning Outcomes (SLO):** 1,2,11

| Module:1 | Environment and Ecosystem | 7hours | SLO: 1, 2 |
|---|---|---|---|

Key environmental problems, their basic causes and sustainable solutions. IPAT equation. Ecosystem, earth – life support system and ecosystem components; Food chain, food web, Energy flow in ecosystem; Ecological succession- stages involved, Primary and secondary succession, Hydrarch, mesarch, xerarch; Nutrient, water, carbon, nitrogen, cycles; Effect of human activities on these cycles.

| Module:2 | Biodiversity | 6 hours | SLO: 1, 2 |
|---|---|---|---|

Importance, types, mega-biodiversity; Species interaction - Extinct, endemic, endangered and rare species; Hot-spots; GM crops- Advantages and disadvantages; Terrestrial biodiversity and Aquatic biodiversity – Significance, Threats due to natural and anthropogenic activities and Conservation methods.

| Module:3 | Sustaining Natural Resources and EnvironmentalQuality | 7 hours | SLO: 1, 2 |
|---|---|---|---|

Environmental hazards – causes and solutions. Biological hazards – AIDS, Malaria, Chemical hazards- BPA, PCB, Phthalates, Mercury, Nuclear hazards- Risk and evaluation of hazards. Water footprint; virtual water, blue revolution. Water quality management and its conservation. Solid and hazardous waste – types and waste management methods.

| Module:4 | Energy Resources | 6hours | SLO: 2, 11 |
|---|---|---|---|

Renewable - Non renewable energy resources- Advantages and disadvantages - oil, Natural gas, Coal, Nuclear energy. Energy efficiency and renewable energy. Solar energy, Hydroelectric

| | | | |
|---|---|---|---|
| power, Ocean thermal energy, Wind and geothermal energy. Energy from biomass, solar-Hydrogen revolution. | | | |
| | | | |
| **Module:5** | **Environmental Impact Assessment** | **6hours** | **SLO: 1, 2** |
| Introduction to environmental impact analysis. EIA guidelines, Notification of Government of India (Environmental Protection Act – Air, water, forest and wild life). Impact assessment methodologies. Public awareness. Environmental priorities in India. | | | |
| | | | |
| **Module:6** | **Human Population Change and Environment** | **6hours** | **SLO: 2,11** |
| Urban environmental problems; Consumerism and waste products; Promotion of economic development – Impact of population age structure – Women and child welfare, Women empowerment. Sustaining human societies: Economics, environment, policies andeducation. | | | |
| | | | |
| **Module:7** | **Global Climatic Change and Mitigation** | **5 hours** | **SLO: 1,2** |
| Climate disruption, Green house effect, Ozone layer depletion and Acid rain.Kyoto protocol, Carbon credits, Carbon sequestration methods and Montreal Protocol.Role of Information technology in environment-Case Studies. | | | |
| | | | |
| **Module:8** | **Contemporary issues** | **2hours** | |
| Lecture by Industry Experts | | | |
| | **Total Lecture hours:** | **45hours** | |

**Text Books**

1. G. Tyler Miller and Scott E. Spoolman (2016), Environmental Science, 15th Edition, Cengage learning.
2. George Tyler Miller, Jr. and Scott Spoolman (2012), Living in the Environment – Principles, Connections and Solutions, 17th Edition, Brooks/Cole, USA.

**Reference Books**

1. David M.Hassenzahl, Mary Catherine Hager, Linda R.Berg (2011), Visualizing Environmental Science, 4thEdition,John Wiley & Sons, USA.

| | | | |
|---|---|---|---|
| Mode of evaluation:Internal Assessment (CAT, Quizzes, Digital Assignments) & FAT | | | |
| Recommended by Board of Studies | 12.08.2017 | | |
| Approved by Academic Council | 46th ACM | Date | 24-8-17 |

| Course code | Engineering Chemistry | L | T | P | J | C |
|---|---|---|---|---|---|---|
| CHY1701 | | 3 | 0 | 2 | 0 | 4 |
| Pre-requisite | Chemistry of 12th standard or equivalent | Syllabus version | | | | |
| | | 1.1 | | | | |

**Course Objectives:**

- To impart technological aspects of applied chemistry
- To lay foundation for practical application of chemistry in engineering aspects

**Expected Course Outcome:**

- Students will be familiar with the water treatment, corrosion and its control, engineering applications of polymers, types of fuels and their applications, basic aspects of electrochemistry and electrochemical energy storage devices

**Student Learning Outcomes (SLO):** 1,2,14

| Module:1 | Water Technology | 5 hours | SLO: 1,14 |
|---|---|---|---|

Hardness of water - hardness causing impurities, pH, DO, TDS, COD and BOD in water; Estimation of hardness by EDTA method-numerical problems. Boiler troubles - scale, sludge, priming, foaming, caustic embrittlement and boiler corrosion; Internal conditioning – Phosphate and calgon conditioning methods

| Module:2 | Water Treatment | 8 hours | SLO:1,14 |
|---|---|---|---|

Water treatment for Industrial purpose: External softening methods: Lime Soda process-numerical problems, Zeolite process and ion exchange including mixed bed ion exchange processes. Steps involved in treatment of water for municipal supply – Water purification for domestic purpose - Activated carbon filtration, UV treatment, Ozonolysis, Reverse osmosis.

| Module:3 | Corrosion | 6 hours | SLO: 2 |
|---|---|---|---|

Types and mechanism – dry and wet corrosion; Forms of corrosion [Differential aeration, pitting, Galvanic and stress corrosion cracking]; Factors affecting corrosion

| Module:4 | Corrosion Control | 4 hours | SLO: 2 |
|---|---|---|---|

Corrosion control methods: Inhibitors – anodic and cathodic and their action; Cathodic protection – sacrificial anodic and impressed current protection methods. Corrosion protection coatings: galvanizing and tinning; electroplating-processes and typical applications; Advanced coating processes – Basic concepts of PVD and CVD

| Module:5 | Electrochemical Energy Systems | 6 hours | SLO: 1,14 |
|---|---|---|---|

Basic concepts of cells and batteries-nominal voltage, operating voltage, capacity, self-discharge, depth of discharge, energy density, service life, shelf life. Working and applications of primary cells - Alkaline cells -and Li-primary cells.

Secondary cells and batteries - Ni-MH cells; Rechargeable lithium cells – chemistry and applications. Fuel cells – Electrochemistry of a $H_2$–$O_2$ fuel cell, Basics of solid oxide fuel cells-applications

| Module:6 | Fuels and Combustion | 8 hours | SLO: 2 |
|---|---|---|---|

Calorific value - Definition of LCV, HCV. Measurement of calorific value using bomb calorimeter and Boy's calorimeter including numerical problems. Combustion of fuels - minimum quantity of air by volume and by weight-Numerical problems. Knocking and chemical structure, octane number and cetane number and their importance;

Biodiesel-synthesis, advantages and commercial applications

| Module:7 | Polymers | 6 hours | SLO: 2 |
|---|---|---|---|

Thermoplastic & Thermo setting resins – comparative properties. Properties and engineering applications of ABS, PVC,Teflon and Bakelite. Compression, injection, extrusion, Transfer moulding methods of plastics.

Conducting polymers: Intrinsic, extrinsic and doped polymers - Polyacetylene-mechanism of conduction- Applications of conducting polymers in LEDs, Mobile phones

| Module:8 | Contemporary issues: | 2 hours | |
|---|---|---|---|

| | | | |
|---|---|---|---|
| Lecture by Industry Experts | | | |
| | **Total Lecture hours:** | **45 hours** | |

| | |
|---|---|
| **Text Book(s)** | |
| 1. | 1. Sashi Chawla, A Text book of Engineering Chemistry, Dhanpat Rai Publishing Co., Pvt. Ltd., Educational and Technical Publishers, New Delhi, 3rd Edition, 2015.<br>2. O.G. Palanna, McGraw Hill Education (India) Private Limited, 9th Reprint, 2015.<br>3. B. Sivasankar, Engineering Chemistry 1st Edition, Mc Graw Hill Education (India), 2008 |
| **Reference Books** | |
| 1. | 1. O.V. Roussak and H.D. Gesser, ***Applied Chemistry-A Text Book for Engineers and Technologists***, Springer Science Business Media, New York, 2nd Edition, 2013.<br>2. S. S. Dara, ***A Text book of Engineering Chemistry,*** S. Chand & Co Ltd., New Delhi, 20th Edition, 2013. |
| Mode of Evaluation: Internal Assessment (CAT, Quizzes, Digital Assignments) & FAT | |

| **List of Challenging Experiments (Indicative)** | | **SLO: 14** |
|---|---|---|
| | Experiment title | Hours |
| 1. | Estimation of Dissolved Oxygen by Winkler's Method | 1 h 50 min |
| **2.** | **Softening of Water through Zeolite Resin – Assessment of Total Hardness using EDTA Method** | **1 h 50 min** |
| **3.** | **Water Preservation through Smart Materials** | **1 h 50 min** |
| 4. | Construction and Working of an Electrochemical Cell | 1 h 50 min |
| 5. | Irrigation Water - Sulphate ion Analysis by Conductometry | 1 h 50 min |
| 6. | Estimation of Calcium Hardness in Water by Flame Photometry | 1 h 50 min |
| 7. | Estimation of Nickel in a Ni-plated Material for Corrosion Protection by Colorimetry | 1 h 50 min |
| 8. | Analysis of Iron in Steel by Potentiometric Method | 1 h 50 min |
| **9.** | **Determination of Aromatic Content in Diesel by Aniline Point Measurement** | **1 h 50 min** |
| 10. | Engineering Polymers - Viscosity and Molecular Weight Analysis | 1 h 50 min |
| **11.** | **Lab Scale Production of Biodiesel from Plant Seeds (demo experiment)** | **3 hours** |
| | | |
| | Total Laboratory Hours | 18 hours |

| | | | |
|---|---|---|---|
| Mode of Evaluation: Viva-voce and Lab performance & FAT | | | |
| Recommended by Board of Studies | 12.08.2017 | | |
| Approved by Academic Council | 46th ACM | Date | 24-8-17 |

| Course code | Problem Solving and Programming | L | T | P | J | C |
|---|---|---|---|---|---|---|
| CSE1001 | | 0 | 0 | 6 | 0 | 3 |
| Pre-requisite | | Syllabus version | | | | |
| | | 1.00 | | | | |

**Course Objectives:**

- Introduce the essential skills for a logical thinking to problem solving
- Introduce the essential skills in programming for problem solving using computer

**Expected Course Outcome:**

- Identify an appropriate approach to solve the problem
- Write a pseudo code for the identified strategy
- Translate the pseudocode into an executable program
- Validate the program for all the possible inputs

**Student Learning Outcomes (SLO):** 2,4,6

| S.No | Topics | LAB Hrs |
|---|---|---|
| 1 | Newton's Second Law of motion is expressed in the formula F = m × a where F is force, m is mass, and a is acceleration. Assume that the user knows the mass of an object and the force on that object but wants to obtain the object's acceleration a. Write a program to Calculate the acceleration and display the result to the user. | 4 |
| 2 | Write a program which will find all such numbers which are divisible by 7 but are not a multiple of 5, between 2000 and 3200 (both included). The numbers obtained should be printed in a comma separated sequence on a single line. | 2 |
| 3 | Write a function called "calc_weight_ on_ planet()" which calculates your equivalent weight on another planet .It should take two arguments: your weight on Earth and the surface gravity of the planet .<br>Note:<br>23.1 m/s2 which is the approximate surface gravity of Jupiter and Earth's surface gravity is approximately 9.8 m/s2. weight is equal to mass times surface gravity. | 6 |
| 4 | Write a function called num_atoms() that calculates how many atoms are in n grams of an element given its atomic weight. This function should take two parameters: the amount of the element in grams and atomic weight of the element<br>Note:. atomic weight of gold (Au) 196.97 with units in grams/mole.<br>Atomic weight of carbon=12.001<br>Atomic weight of hydrogen=1.008<br>Avogadro's number is a constant, 6.022 × 1023 | 6 |
| 5 | Write a recursive function and an iterative function to compute the Fibonacci sequence. Compare the performance of recursive and iterative function | 6 |
| 6 | Write a program that prompts the user to enter a list of words and stores in a list only those words whose first letter occurs again within the word (for example, 'Baboon'). The program should display the resulting list. | 6 |
| 7 | Write a version of a palindrome recognizer that also accepts phrase palindromes such as "Go hang a salami I'm a lasagna hog.", "Was it a rat I | 6 |

| | | |
|---|---|---|
| | saw?", "Step on no pets", "Sit on a potato pan, Otis", "Lisa Bonet ate no basil", "Satan, oscillate my metallic sonatas", "I roamed under it as a tired nude Maori", "Rise to vote sir", or the exclamation "Dammit, I'm mad!". Note that punctuation, capitalization, and spacing are usually ignored. | |
| 8 | In English, the present continuous is formed by adding the suffix -ing to the verb go -> going. A simple set of heuristic rules can be given as follows:<br>1. If the verb ends in e, drop the e and add ing (if not exception: be, see, flee, knee, etc.)<br>2. If the verb ends in ie, change ie to y and add ing<br>3. For words consisting of consonant-vowel-consonant, double the final letter before adding ing<br>4. By default just add ing Write a function make_ing_form() which given a verb converts to present Continuous form. Test your function with words such as lie, see, move and hug. | 6 |
| 9 | Define a procedure histogram() that takes a list of integers and prints a histogram to the screen. For example, histogram([4, 9, 7]) should print the following:<br>****<br>*********<br>******* | 4 |
| 10 | A pangram is a sentence that contains all the letters of the English alphabet at least once, for example: The quick brown fox jumps over the lazy dog. Write a function to check a sentence to see if it is a pangram or not. | 2 |
| 11 | Write a program to solve a classic ancient Chinese puzzle: We count 35 heads and 94 legs among the chickens and rabbits in a farm. How many rabbits and how many chickens do we have? | 2 |
| 12 | A website requires the users to input username and password to register. Write a program to check the validity of password input by users.<br>Following are the criteria for checking the password:<br>1. At least 1 letter between [a-z]<br>2. At least 1 number between [0-9]<br>3. At least 1 character from [$#@]<br>4. Minimum length of transaction password: 6<br>5. Maximum length of transaction password: 12<br>6. At least 1 letter between [A-Z]<br>Your program should accept a sequence of comma separated passwords and will check them according to the above criteria. Passwords that match the criteria are to be printed, each separated by a comma. | 6 |
| 13 | Write a program that maps a list of words into a list of integers representing the lengths of the correponding words. Write it in three different ways: 1) using a for-loop, 2) using the higher order function map(), and 3) using list comprehensions | 4 |
| 14 | Write a program that prompts the user to enter types of fruit, and weight of fruit. The program should then display the information in the form fruit, weight listed in alphabetical order, one fruit type per line as shown below<br>Apple, 6 lbs.<br>Banana, 11 lbs. etc. | 6 |
| 15 | Write a program to sort the (name, age, height) tuples by ascending order where name is string, age and height are numbers. The tuples are input by console. The sort criteria is: | 6 |

| | | |
|---|---|---|
| | 1: Sort based on name<br>2: Then sort based on age;<br>3: Then sort by score. | |
| 16 | In the word game Mad Libs, people are asked to provide a part of speech, such as a noun, verb, adverb, or adjective. The supplied words are used to fill in the blanks of a preexisting template or replace the same parts of speech in a preexisting sentence. Although we don't yet have the tools to implement a full Mad Libs game, we can implement code that demonstrates how the game works for a single sentence. Consider this sentence from P. G. Wodehouse:<br>Jeeves lugged my purple socks out of the drawer as if he were a vegetarian fishing a caterpillar out of his salad.<br>Write a program that will do the following:<br>• Print the following template:<br>Jeeves [verb] my [adjective] [noun] out of the [noun]<br>as if he were a vegetarian fishing a [noun] out of his<br>salad.<br>• Prompt the user for a verb, an adjective, and three nouns.<br>• Print the template with the terms in brackets replaced with the words the user provided. | 6 |
| 17 | In cryptography, a Caesar Cipher is a very simple encryption techniques in which each letter in the plain text is replaced by a letter some fixed number of positions down the alphabet. For example, with a shift of 3, A would be replaced by D, B would become E, and so on.. ROT-13 ("rotate by 13 places") is a widely used example of a Caesar cipher where the shift is 13.<br>Write a program to implement an encoder/decoder of ROT-13. Once you're done, you will be able to read the following secret message:<br>Pnrfne pvcure? V zhpu cersre Pnrfne fnynq! | 6 |
| 18 | Write a program that can check an HTML document for proper opening and closing tags<br><html><br><head><br><title><br>Example<br></title><br></head><br><body><br><h1>Hello, world</h1><br></body><br></html> | 6 |
| | | |
| | Total Lab Hours: | 90 |

| | | | |
|---|---|---|---|
| Recommended by Board of Studies | DD-MM-YYYY | | |
| Approved by Academic Council | No. xx | Date | DD-MM-YYYY |

**An overview :**

**Problem solving:**

General problem solving concepts, approaches and challenges, problem solving with computers, problem solving tools: flowcharts, algorithms, data structures, Pseudo code.

**Various Approaches** :

Solve by analogy, Decompose the task into smaller subtasks, Building block approach, Merging solutions, Algorithmic thinking, Choice of appropriate data structures, Implementation of the

| |
|---|
| Pseudo-code, implementing the code, Testing the solution |
| **Problem solving strategies:**<br>Abstraction, analogy, brainstorming, divide and conquer, reduction, trial and error, heuristics, exhaustive search, backtracking, Greedy |
| **Data representation:**<br>Data processing, data types: primitive and user-defined. arrays: one-dimensional, two-dimensional, multi-dimensional, pointers, stacks, queues, list, linked list, file structures |
| **Introduction to program structure:**<br>Variables and constants, local and global variables, expressions, control structures, selection structures, arithmetic, relational and logical operators, Conditional and looping statements, programming in manageable pieces: program modules, subprograms, functions, recursion<br>**Problem to code approach:**<br>Problem statement, problem analysis, program design, program code, program test |
| **Sorting (Numbers and Strings) :**<br>Bubble sort, Insertion sort, Selection Sort |
| **Searching (Numbers and Strings):**<br>Binary search, Random search, Search for Max-Min |

| Course code | Problem Solving and Object Oriented Programming | L | T | P | J | C |
|---|---|---|---|---|---|---|
| CSE1002 | | 0 | 0 | 6 | 0 | 3 |

| Pre-requisite | Syllabus version |
|---|---|
| | 1.00 |

**Course Objectives:**

- To emphasis the benefits of object oriented concepts
- To enable the students to solve the real time applications using object oriented programming features

**Expected Course Outcome:**

- Apply the appropriate programming paradigms for real time applications
- Choice of appropriate concepts in structured /object oriented programming to design a solution for complex problems

| Student Learning Outcomes (SLO): | 1, 9, 17 |
|---|---|

| S. No | Topics | Lab Hrs |
|---|---|---|
| 1 | Conditional and looping statements – arrays | 4 |
| 2 | Functions – recursion | 2 |
| 3 | Pointers | 2 |
| 4 | Dynamic memory allocation - structure – union | 4 |
| 5 | Inline functions, Exception handling(standard), functions with default arguments, functions with reference(independent reference, function pass by reference, function return by reference) | 8 |
| 6 | UML – class diagram of OOP concepts | 2 |
| 7 | Classes and objects | 2 |
| 8 | Static data members, dynamic memory allocation | 2 |
| 9 | Array of objects(static and dynamic) | 2 |
| 10 | Constructors(default, parameter less, parameterised and copy constructors and its importance) and destructors | 4 |
| 11 | Friend functions | 2 |

| | | |
|---|---|---|
| 12 | Friend class | 2 |
| 13 | Function overloading concept | 4 |
| 14 | Operator overloading – unary operators | 4 |
| 15 | Operator overloading – binary operator | 2 |
| 16 | Operator overloading – Type Conversion | 2 |
| 17 | Single and hierarchy inheritance | 2 |
| 18 | Multilevel inheritance | 2 |
| 19 | Multiple inheritance | 2 |
| 20 | Multipath, hybrid inheritance | 2 |
| 21 | Dynamic polymorphism – virtual functions | 4 |
| 22 | Dynamic polymorphism – pure virtual functions | 2 |
| 23 | Exception handling (User-defined Exceptions) | 2 |
| 24 | Generic programming – function template | 4 |
| 25 | Generic programming – Class template | 2 |
| 26 | Generic programming – Class Template Inheritance | 2 |
| 27 | STL – Container, Algorithm, Iterator- vector | 2 |
| 28 | STL –list, stack | 4 |
| 29 | STL - Map | 2 |
| 30 | Formatted iostreams | 2 |
| 31 | Manipulators , overloading Inserters(<<) and Extractors(>>) | 2 |
| 32 | Sequential and Random files – writing and reading objects into/from files | 6 |
| | **Total Lecture hours:** | 90 |

**Text Book(s)**


1. Stanley B Lippman, Josee Lajoie, Barbara E, Moo, “C++ primer”, Fifth edition, Addison-Wesley, 2012

| | |
|---|---|
| 2. | Ali Bahrami, Object oriented Systems development, Tata McGraw - Hill Education, 1999 |
| 3. | Brian W. Kernighan, Dennis M. Ritchie , The 'C' programming Language, 2nd edition, Prentice Hall Inc., 1988 |

**Reference Books**

| | |
|---|---|
| 1. | Bjarne stroustrup, The C++ programming Language, Addison Wesley, 4th edition, 2013 |
| 2. | Harvey M. Deitel and Paul J. Deitel, C++ How to Program, 7th edition, Prentice Hall, 2010. |
| 3. | Christian Bauer, Gavin King, Gary Gregory, Java Persistence with Hibernate, 2015. |
| 4. | Maureen Sprankle and Jim Hubbard, Problem solving and Programming concepts, 9th edition, Pearson Education, 2014 |

**List of Challenging Experiments (Indicative)**

| | |
|---|---|
| 1. | **Postman Problem**<br>A postman needs to walk down every street in his area in order to deliver the mail. Assume that the distances between the streets along the roads are given. The postman starts at the post office and returns back to the post office after delivering all the mails. Implement an algorithm to help the post man to walk minimum distance for the purpose. |
| 2. | **Budget Allocation for Marketing Campaign**<br>A mobile manufacturing company has got several marketing options such as Radio advertisement campaign, TV non peak hours campaign, City top paper network, Viral marketing campaign, Web advertising. From their previous experience, they have got a statistics about paybacks for each marketing option. Given the marketing budget (rupees in crores) for the current year and details of paybacks for each option, implement an algorithm to determine the amount that shall spent on each marketing option so that the company attains the maximum profit. |
| 3. | **Missionaries and Cannibals**<br>Three missionaries and three cannibals are on one side of a river, along with a boat that can hold one or two people. Implement an algorithm to find a way to get everyone to the other side of the river, without ever leaving a group of missionaries in one place outnumbered by the cannibals in that place. |
| 4. | **Register Allocation Problem**<br><br>A **register** is a component of a computer processor that can hold any type of data and can be accessed faster. As registers are faster to access, it is desirable to use them to the maximum so that the code execution is faster. For each code submitted to the processor, a register interference graph (RIG) is constructed. In a RIG, a node represents a temporary variable and an edge is added between two nodes (variables) t1 and t2 if they are live simultaneously at some point in the program. During register allocation, two temporaries can be allocated to the same register if there is no edge connecting them. Given a RIG representing the dependencies between variables in a code, implement an algorithm to determine the number |

| | |
|---|---|
| | of registers required to store the variables and speed up the code execution. |
| 5. | **Selective Job Scheduling Problem**<br><br>A **server** is a machine that waits for requests from other machines and responds to them. The purpose of a server is to share hardware and software resources among clients. All the clients submit the jobs to the server for execution and the server may get multiple requests at a time. In such a situation, the server schedule the jobs submitted to it based on some criteria and logic. Each job contains two values namely time and memory required for execution. Assume that there are two servers that schedules jobs based on time and memory. The servers are named as Time_Schedule_Server and memory_Schedule_Server respectively. Design a OOP model and implement the time_Schedule_Server and memory_Schedule_Server. The Time_Schedule_Server arranges jobs based on time required for execution in ascending order whereas memory_Schedule_Server arranges jobs based on memory required for execution in ascending order. |
| 6. | **Fragment Assembly in DNA Sequencing**<br><br>DNA, or deoxyribonucleic acid, is the hereditary material in humans and almost all other organisms. The information in DNA is stored as a code made up of four chemical bases: adenine (A), guanine (G), cytosine (C), and thymine (T). In DNA sequencing, each DNA is sheared into millions of small fragments (reads) which assemble to form a single genomic sequence ("superstring"). Each read is a small string. In such a fragment assembly, given a set of reads, the objective is to determine the shortest superstring that contains all the reads. For example, given a set of strings, {000, 001, 010, 011, 100, 101, 110, 111} the shortest superstring is 0001110100. Given a set of reads, implement an algorithm to find the shortest superstring that contains all the given reads. |
| 7. | **House Wiring**<br>An electrician is wiring a house which has many rooms. Each room has many power points in different locations. Given a set of power points and the distances between them, implement an algorithm to find the minimum cable required. |

| | | | |
|---|---|---|---|
| | | | |
| Recommended by Board of Studies | DD-MM-YYYY | | |
| Approved by Academic Council | No. xx | Date | DD-MM-YYYY |

## Course Description

This course will ensure the competency in the following.

| S.No | Topics | Lab Hrs | SLO |
|---|---|---|---|
| **1** | **Solving by Divide and Conquer and recursion:** | 12 | |

| | | | |
|---|---|---|---|
| | Tower of Hanoi problem<br>**Structured Programming**<br>conditional and looping statements-arrays – functions - pointers – dynamic memory allocation - structure | | 1,9,17 |
| 2 | **Solving by Abstraction:**<br>Travelling salesman Problem<br>**Introduction to object oriented approach:**<br>Why object oriented programming?- Characteristics of object oriented language: classes and objects - encapsulation-data abstraction- inheritance - polymorphism - Merits and Demerits of object oriented programming. UML- class diagram of OOP - Inline function – default argument function- Exception handling(Standard) - reference: independent reference – function returning reference – pass by reference | 10 | 1, 9, 17 |
| **3** | **Solving by Exhaustive approach:**<br>Cabbage, Goat, farmer problem<br>**Case study –** Railway Reservation Systems<br>**Classes and objects:**<br>Definition of classes – access specifier – class versus structure – constructor – destructor – copy constructor and its importance – array of objects – dynamic objects- friend function-friend class | 14 | 1,9,17 |
| **4** | **Solving by Greedy**<br>Scheduling Problem<br>**Case study** - Railway Reservation Systems<br>**Polymorphism and Inheritance :**<br>Polymorphism-compile time polymorphism – function overloading – operator overloading - . Inheritance-types of inheritance- constructors and destructors in inheritance – constraints of multiple inheritance-virtual base class - run time polymorphism-function overriding. | 26 | 1,9,17 |
| **5** | **Solving by Greedy** | 18 | 1,9,17 |

| | | | |
|---|---|---|---|
| | Knapsack Problem<br>**Case study** - Railway Reservation Systems<br>**Exception handling and Templates**<br>Exception handling(user-defined exception)- Function template , Class template – Template with inheritance , STL – Container, Algorithm, Iterator -vector, list, stack, map | | |
| 6 | **Solving by Divide and conquer**<br>Strassen's Matrix multiplications<br>**Case study -** Railway Reservation Systems<br>IOstreams and Files<br>IOstreams, Manipulators- overloading Inserters(<<) and Extractors(>>)- Sequential and Random files – writing and reading objects into/from files | 10 | 1,9,17 |
| | **Total Lab Hours** | 90 | |

| Course code | Course title | L | T | P | J | C |
|---|---|---|---|---|---|---|
| ENG1011 | English For Engineers | 0 | 0 | 4 | 0 | 2 |
| Pre-requisite | Cleared English Proficiency Test (EPT)/ Effective English | Syllabus version 1.0 | | | | |

**Course Objective:**

- To enable students listen, speak, read and write effectively for academic purposes and face real-life situations

**Expected Course Outcome:**

- Facilitate students to communicate effectively in academic and social contexts

**Student Learning Outcomes (SLO): 3, 16, 18**

| | | | |
|---|---|---|---|
| **Module:1** | **Listening** | **4 hours** | **SLO: 3, 16** |
| Casual and Academic | | | |
| **Module:2** | **Speaking** | **4 hours** | **SLO: 3, 16** |
| Socializing Skills - Introducing Oneself- His / Her Goals & SWOT | | | |
| **Module:3** | **Reading** | **2 hours** | **SLO: 16** |
| Skimming and Scanning | | | |
| **Module:4** | **Writing** | **2 hours** | **SLO: 16** |
| Error-free sentences, Paragraphs | | | |
| **Module:5** | **Listening** | **4 hours** | **SLO: 18** |
| News (Authentic Material): Analyzing General and Domain Specific Information | | | |
| **Module:6** | **Speaking** | **4 hours** | **SLO: 16, 18** |
| Group Discussion on factual, controversial and abstract issues | | | |
| **Module:7** | **Reading:** | **2 hours** | **SLO: 3, 16** |
| Extensive Reading | | | |
| **Module:8** | **Writing** | **2 hours** | **SLO: 3, 16** |
| Email Etiquette with focus on Content and Audience | | | |
| **Module:9** | **Listening** | **4 hours** | **SLO: 3, 16** |
| Speeches : General and Domain Specific Information | | | |
| **Module:10** | **Speaking** | **4 hours** | **SLO: 16, 18** |
| Developing Persuasive Skills - Turncoat and Debate | | | |
| **Module:11** | **Reading** | **2 hours** | **SLO: 16, 18** |
| Intensive Reading | | | |
| **Module:12** | **Writing** | **2 hours** | **SLO: 16, 18** |

| | | | |
|---|---|---|---|
| Data Transcoding | | | |
| **Module:13** | **Cross Cultural Communication** | **4 hours** | **SLO: 3, 16, 18** |
| Understanding Inter and Cross-Cultural Communication Nuances | | | |
| **Module:14** | **Speaking** | **4 hours** | **SLO: 3, 16, 18** |
| Public Speaking/Extempore /Monologues | | | |
| **Module:15** | **Reading for research** | **2 hours** | **SLO: 3, 16, 18** |
| Reading Scientific/Technical Articles | | | |
| **Module:16** | **Writing** | **2 hours** | **SLO: 3, 16, 18** |
| Creating a Digital/Online Profile – LinkedIn (Résumé/Video Profile) | | | |
| **Module:17** | **Speaking:** | **4 hours** | **SLO: 3, 16, 18** |
| Mock Job/Placement Interviews | | | |
| **Module:18** | **Writing** | **2 hours** | **SLO: 3, 16, 18** |
| Report Writing | | | |
| **Module:19** | **Speaking** | **4 hours** | **SLO: 3, 16, 18** |
| Presentation using Digital Tools | | | |
| **Module:20** | **Vocabulary** | **2 hours** | **SLO: 16, 18** |
| Crossword Puzzles/Word games | | | |
| | | | |
| | **Total Lecture hours:** | **60 hours** | |

**Text Book(s)**

| | |
|---|---|
| 1. | Clive Oxenden and Christina Latham-Koenig, New English File: Advanced: Teacher's Book with Test and Assessment CD-ROM: Six-level general English course for adults Paperback – Feb 2013, Oxford University Press, UK |
| 2 | Clive Oxenden and Christina Latham-Koenig, New English File: Advanced Students Book Paperback – Feb 2012, Oxford University Press, UK |
| 3 | Michael Vince, Language Practice for Advanced - Students Book, Feb. 2014, 4th Edition, Macmillan Education, Oxford, United Kingdom |

**Reference Books**

| | |
|---|---|
| 1. | Steven Brown, Dorolyn Smith,Active Listening 3, 2011, 3rd Edition,Cambridge University Press, UK |
| 2. | Tony Lynch, Study Listening, 2013, 2nd Edition, Cambridge University Press, UK |
| 3. | Liz Hamp-Lyons, Ben Heasley,Study Writing, 2010, 2nd Edition, Cambridge University Press, UK |
| 4. | Kenneth Anderson, Joan Maclean, Tony Lynch, Study Speaking, 2013, 2nd Edition, Cambridge University Press, UK |

| | |
|---|---|
| 5. | Eric H. Glendinning, Beverly Holmstrom,Study Reading, 2012, 2nd Edition Cambridge University Press, UK |
| 6. | Michael Swan, Practical English Usage (Practical English Usage),Jun 2017, 4th edition, Oxford University Press, UK |
| 7. | Michael McCarthy, Felicity O'Dell, English Vocabulary in Use Advanced (South Asian Edition), May 2015, Cambridge University Press, UK |
| 8. | Michael Swan, Catherine Walter, Oxford English Grammar Course Advanced, Feb 2012, 4th Edition, Oxford University Press, UK |
| 9. | Heather Silyn-Roberts, Writing for Science and Engineering: Papers, Presentations and Reports, Jun 2016, 2nd Edition, Butterworth-Heinemann, UK |

**Mode of Evaluation**: Mini Project, Flipped Class Room, Lecture, PPT's, Role play, Assignments Class/Virtual Presentations, Report and beyond the classroom activities

| **List of Challenging Experiments (Indicative)** | | **SLO: 3, 16, 18** |
|---|---|---|
| 1. | Create a Digital or Online Profile or a Digital Footprint | 6 hours |
| 2. | Prepare a video resume | 8 hours |
| 3. | Analyse a documentary critically | 4 hours |
| 4. | Turn Coat- Speaking for and against the topic / Activities through VIT Community Radio | 6 hours |
| 5 | Present a topic using 'Prezi' | 6 hours |
| 6 | Analyse a case on cross cultural communication critically | 6 hours |
| 7 | Create a list of words relating to your domain | 4 hours |
| 8 | Listen to a conversation of native speakers of English and answer the following questions | 6 hours |
| 9 | Read an article and critically analyse the text in about 150 words | 6 hours |
| 10 | Read an autobiography and role play the character in class by taking an excerpt from the book | 8 hours |
| | **Total Practical Hours** | **60 hours** |

Mode of evaluation: Mini Project, Flipped Class Room, Lecture, PPT's, Role play, Assignments Class/Virtual Presentations, Report and beyond the classroom activities

| | | | |
|---|---|---|---|
| Recommended by Board of Studies | 22-07-2017 | | |
| Approved by Academic Council | No. xx | Date | DD-MM-YYYY |

| Course code | Ethics and Values | L | T | P | J | C |
|---|---|---|---|---|---|---|
| HUM1021 | | 2 | 0 | 0 | 0 | 2 |
| Pre-requisite | Nil | Syllabus version | | | | |
| | | 1.0 | | | | |

**Course Objectives:**

- To inculcate moral values and ethical standards in students

**Expected Course Outcome:**

- Ability to follow sound morals and ethical values scrupulously to prove as good citizens

**Student Learning Outcomes (SLO):** 2, 10, 11, 12

| Module:1 | Being good and responsible | 5 hours | SLO: 2, 11 |
|---|---|---|---|

Gandhian values such as truth and non-violence – comparative analysis on leaders of past and present – society's interests versus self-interests

Personal Social Responsibility: Helping the needy, charity and serving the society.

| Module:2 | Social Issues 1 | 4 hours | SLO: 2, 11 |
|---|---|---|---|

Harassment – types - Prevention of harassment, violence and terrorism

| Module:3 | Social Issues 2 | 4 hours | SLO: 2, 11 |
|---|---|---|---|

Corruption: ethical values, causes, impact, laws, prevention – electoral malpractices

white collar crimes - tax evasions – unfair trade practices

| Module:4 | Addiction and Health | 3 hours | SLO: 10, 12 |
|---|---|---|---|

Peer pressure - Alcoholism: ethical values, causes, impact, laws, prevention – Ill effects of smoking - Prevention of Suicides

Sexual Health: Prevention and impact of pre-marital pregnancy and Sexually Transmitted Diseases

| Module:5 | Drug Abuse | 4 hours | SLO: 10, 12 |
|---|---|---|---|

Abuse of different types of legal and illegal drugs: ethical values, causes, impact, laws and prevention

| Module:6 | Personal and Professional Ethics | 3 hours | SLO: 10, 11 |
|---|---|---|---|

Dishonesty - Stealing - Malpractices in Examinations – Plagiarism

| Module:7 | Abuse of technologies | 4 hours | SLO: 2, 10 |
|---|---|---|---|

Hacking and other cyber crimes, addiction to mobile phone usage, video games and social

| | | | |
|---|---|---|---|
| networking websites | | | |
| | | | |
| **Module:8** | **Invited Talk:** Contemporary Issues | **3 hours** | **SLO: 2, 12** |
| | | | |
| | | | |
| | **Total Lecture hours:** | **30hours** | |

| | |
|---|---|
| **Reference Books** | |
| 1. | Dhaliwal, K.K (2016), "Gandhian Philosophy of Ethics: A Study of Relationship between his Presupposition and Precepts, Writers Choice, New Delhi, India |
| 2. | Vittal, N (2012), "Ending Corruption? - How to Clean up India?", Penguin Publishers, UK |
| 3. | Birch, S (2011), "Electoral Malpractice", Oxford University Press, UK |
| 4. | Pagliaro, L.A. and Pagliaro, A.M (2012), "Handbook of Child and Adolescent Drug and Substance Abuse: Pharmacological , Developmental and Clinical Considerations", Wiley Publishers, U.S.A |
| 5. | Pandey, P. K (2012), "Sexual Harassment and Law in India", Lambert Publishers, Germany |
| **Mode of Evaluation**: Quizzes, CAT, Digital assignments, poster/collage making and projects | |

| | | | |
|---|---|---|---|
| Recommended by Board of Studies | 26-07-2017 | | |
| Approved by Academic Council | No. xx | Date | DD-MM-YYYY |

| Course code | Technical Answers for Real World Problems (TARP) | L | T | P | J | C |
|---|---|---|---|---|---|---|
| ITE3999 | | 1 | 0 | 0 | 8 | 3 |
| Pre-requisite | PHY1999 and 115 Credits Earned | Syllabus version | | | | |
| | | 1.0 | | | | |

**Course Objectives:**

- To help students to identify the need for developing newer technologies for industrial / societal needs
- To train students to propose and implement relevant technology for the development of the prototypes / products
- To make the students learn to the use the methodologies available for analysing the developed prototypes / products

**Expected Course Outcome:**

- The students would have learnt the intricacies involved in problem identification and would have develop the art of using relevant technology for product development

| Student Learning Outcomes (SLO): | 5, 6, 17 |
|---|---|

| Module:1 | | 2 hours | SLO: 5,6,17 |
|---|---|---|---|

Steps involved:

1. Strategies to identify the societal and industrial problems that need to be solved
2. SWOC analysis of the available technologies to overcome the problem
3. Possible technology revolution in the next 5 – 10 years
4. Analysis of the problems of present and future
5. Challenges in sustainable prototype / product development
6. Design of specific workflow in developing the prototype / product
7. Validation of the developed prototype / product
8. Analysis of the prototype/product with respect to social, economical, environmental relevance

(The proposed contact hours are for discussion on the projects)
(Projects to be done by a group of 6 – 10 students)

**Student Learning Outcomes:**

5. Having design thinking capability
6. Having an ability to design a component or a product applying all the relevant standards and with realistic constraints

17. Having an ability to use techniques, skills and modern engineering tools necessary for engineering practice

Mode of Evaluation: (No FAT) Continuous Assessment the project done – Mark weightage of 20:30:50 – project report to be submitted.

| Recommended by Board of Studies | 05-03-2016 | | |
|---|---|---|---|
| Approved by Academic Council | No.40 | Date | 18-03-2016 |

| Course code | Comprehensive Examination | L | T | P | J | C |
|---|---|---|---|---|---|---|
| ITE4098 | | 0 | 0 | 0 | 0 | 2 |
| Pre-requisite | | Syllabus version | | | | |
| | | 1.00 | | | | |

**Student Learning Outcomes (SLO):** 2

**Digital Logic and Microprocessor**

Simplification of Boolean functions using K-Map – Combinational logic: Adder, subtractor, encoder, decoder, multiplexer, de-multiplexer – Sequential Logic: Flip flops- 8086 Microprocessor: instructions – peripherals: 8255, 8254, 8257.

**Computer Architecture and Organization**

Instructions - Instruction types- Instruction Formats - Addressing Modes- Pipelining- Data Representation - Memory Hierarchy- Cache memory-Virtual Memory- I/O Fundamentals- I/O Techniques - Direct Memory Access - Interrupts-RAID architecture

**Programming, Data Structures and Algorithms**

Programming in C; Algorithm Analysis – Iterative and Recursive Algorithms; ADT - Stack and its Applications - Queue and its Applications; Data Structures – Arrays and Linked Lists; Algorithms - Sorting – Searching; Trees – BST, AVL; Graphs – BFS , DFS , Dijkstra's Shortest Path Algorithm.

**Theory of Computation**

Deterministic Finite Automata, Non deterministic Finite Automata, Regular Expressions, Context Free Grammar, Push down Automata and Context Free Languages, Turing Machines.

**Web Technologies**

Web Architecture- JavaScript – objects String, date, Array, Regular Expressions, DHTML-HTML DOM Events; Web Server – HTTP- Request/Response model-RESTful methods- State Management – Cookies , Sessions – AJAX.

**Operating Systems**

Processes, Threads, Inter-process communication, CPU scheduling, Concurrency and synchronization, Deadlocks, Memory management and Virtual memory & File systems.

**Database Management System**

DBMS, Schema, catalog, metadata, data independence, pre-compiler; Users-naïve, sophisticated, casual ;ER Model- Entity, attributes, structural constraints; Relational Model-Constraints, Relational Algebra operations; SQL- DDL, DML, TCL, DCL commands, basic queries and Top N queries; Normalization-properties, 1NF, 2NF, 3NF, BCNF; Indexing-different types, Hash Vs B-tree Index; Transaction-problems, Concurrency Control-techniques, Recovery-methods.

**Data Communication and Computer Networks**

Circuit Switching, Packet Switching, Frame Relay, Cell Switching, ATM , OSI Reference model, TCP\IP, Network topologies, LAN Technologies, Error detection and correction techniques, Internet protocols , IPv4/IPv6, Routing algorithms, TCP and UDP, Sockets, Congestion control, Application Layer Protocols, Network Security: Basics of public and private key cryptosystems- Digital Signatures and Hash codes, Transport layer security, VPN, Firewalls.

| | | | |
|---|---|---|---|
| Recommended by Board of Studies | 05-03-2016 | | |
| Approved by Academic Council | No. 40 | Date | 18-03-2016 |

| Course Code | Calculus for Engineers | L | T | P | J | C |
|---|---|---|---|---|---|---|
| MAT-1011 | | 3 | 0 | 2 | 0 | 4 |
| Pre-requisite | 10+2Mathematics or MAT1001 | Syllabus Version | | | | |
| | | 1.00 | | | | |

**Course Objectives:**

- To provide the requisite and relevant backgroundnecessaryto understandthe other importantengineeringmathematics courses offered forEngineers and Scientists.
- To introduce importanttopics ofapplied mathematics,namelySingle and Multivariable Calculusand Vector Calculusare introduced.

**ExpectedCourse Outcome**

At the endofthis course the students are expected to learn

- howtoapplysingleintegralstofindtheareaandvolumebyusingthetechniquesof definiteintegrals andimproper integrals
- howto findthe maximaandminima for functions involvingsingle orseveral variables
- howto evaluatemultiple integrals inCartesian, Cylindrical andSpherical geometries.

| StudentLearning Outcomes (SLO): | 1,2,9 |
|---|---|

| Module:1 | Applications ofSingle Variable | 9hours | SLO: 1,2 |
|---|---|---|---|

Differentiation- Extrema on an Interval-Rolle'sTheorem andthe Mean Value Theorem-IncreasingandDecreasing functions andFirst derivative test-Second derivative test-Maxima andMinima-Concavity.Integration-Averagefunction value- Areabetween curves- Volumes ofsolids ofrevolution-Beta andGamma functions–interrelation

| Module:2 | Laplacetransforms | 7hours | SLO: 1,9 |
|---|---|---|---|

DefinitionofLaplacetransform-Properties-Laplacetransformofperiodicfunctions-Laplace transform ofunitstepfunction,Impulse function-Inverse Laplace transform-Convolution.

| Module:3 | Multivariable Calculus | 4hours | SLO: 1,2 |
|---|---|---|---|

Functions oftwo variables-limits and continuity-partial derivatives –total differential-Jacobian anditProsperities.

| | | | |
|---|---|---|---|
| **Module:4** | **Applications ofMultivariable Calculus** | **5hours** | **SLO:** 1,9 |
| Taylor'sexpansion fortwo variables–maxima andminima–constrainedmaxima andminima-Lagrange's multiplier method. | | | |
| | | | |
| **Module:5** | **Multiple integrals** | **8hours** | **SLO:** 2,9 |
| Evaluationofdoubleintegrals–changeoforderofintegration–change ofvariablesbetween Cartesian and polar co-ordinates- - Evaluation of triple integrals-change of variables betweenCartesianand cylindricaland sphericalco-ordinates--evaluationof multiple integrals using gammaandbeta functions. | | | |
| | | | |
| **Module:6** | **Vector Differentiation** | **5hours** | **SLO:** 1,9 |
| Scalarand vectorvalued functions–gradient,tangentplane–directionalderivative-divergenceandcurl–scalarandvector potentials–Statementofvector identities-Simple problems | | | |
| | | | |
| **Module:7** | **Vector Integration** | **5hours** | **SLO:** 2,9 |
| line, surface andvolumeintegrals - StatementofGreen's, Stoke's andGauss divergence theorems -verification andevaluationof vectorintegrals using them. | | | |
| | | | |
| **Module:8** | **Contemporary Issues:** | **2hours** | |
| Industry Expert Lecture | | | |
| | **Total Lecture hours:** | **45hours** | |

**TextBook(s)**

1. Thomas' Calculus byGeorge B.Thomas,D.WeirandJ.Hass,13th edition2014, Pearson.
2. AdvancedEngineeringMathematics by ErwinKreyszig, 10th Edition,John Wiley

**Reference Books**

1. Higher Engineering Mathematics by B.S.Grewal,43rdEdition ,Khanna Publishers,India,2015
2. Higher Engineering Mathematics by John Bird,5th Edition,ElsevierLimited, 2006.
3. Calculus:EarlyTranscendentals by James Stewart,8th edition,Cengage

**Mode ofEvaluation**

Digital Assignments, Quiz,Continuous Assessments, Final AssessmentTest

| | |
|---|---|
| **ListofChallenging Experiments (Indicative)** | **SLO:** 1,2,9 |

| | | |
|---|---|---|
| 1. | Introduction to MATLAB throughmatrices,andgeneral Syntaxes, | 2hours |
| 2 | Plottingand visualizingcurves andsurfaces in MATLAB– Symbolic computations usingMATLAB | 2hours |
| 3. | Evaluating Extremumofa single variable function | 2hours |
| 4. | Understandingintegration as Areaunder the curve | 2hours |
| 5. | Evaluation of Volumeby Integrals (Solids ofRevolution ) | 2hours |
| 6. | Evaluating Maxima andminima of functions ofseveral variables | 2hours |
| 7. | ApplyingLagrange multiplier optimization method | 2hours |
| 8. | Evaluating Volume under surfaces | 2hours |
| 9. | Evaluating triple integrals | 2hours |
| 10. | Evaluating gradient,curl and divergence | 2hours |
| 11. | Evaluating line integralsin vectors | 2hours |
| 12. | ApplyingGreenstheorem to real worldproblems | 2hours |
| | Total LaboratoryHours | 24hours |

| | | | |
|---|---|---|---|
| **Mode of Evaluation:** | | | |
| Weekly Assessment, Final AssessmentTest | | | |
| RecommendedbyBoardofStudies | | | |
| Approvedby Academic Council | No. | Date | |

| Course Code | Statistics for Engineers | L | T | P | J | C |
|---|---|---|---|---|---|---|
| MAT-2001 | | 3 | 0 | 2 | 0 | 4 |
| Pre-requisite | MAT1011- Calculus for Engineers | Syllabus Version | | | | |
| | | 1.0 | | | | |

**Course Objectives:**

- Toprovidestudentswithaframeworkthatwillhelpthemchoosetheappropriate descriptive methods in various data analysis situations.
- To analyse distributions and relationships of real-time data.

**ExpectedCourse Outcome**

At the endofthis course the students are expected to

- Have anunderstandingofthe probabilityconcepts.
- Analyze the problems connected with statisticsand reliability.
- Understandhowtomakethetransitionfromarealproblemtoaprobabilitymodel for that problem.Themostdesirableistoexposestudentsto practical applicationsof

| StudentLearning Outcomes (SLO): | 1,2,7 |
|---|---|

| Module:1 | Introductionto Statistics | 6hours | SLO: 2,7 |
|---|---|---|---|

Introductiontostatisticsand data analysis-Measuresofcentral tendency–Measuresof variability-[Moments-Skewness-Kurtosis(Conceptsonly)].

| Module:2 | Randomvariables | 8hours | SLO: 1,7 |
|---|---|---|---|

Introduction -randomvariables-ProbabilitymassFunction,distributionand densityfunctions-joint Probabilitydistributionandjointdensityfunctions-Marginal,conditional distributionanddensity functions-Mathematical expectation,and itspropertiesCovariance,momentgeneratingfunction–characteristicfunction.

| Module:3 | Correlationand regression: | 4hours | SLO: 2,7 |
|---|---|---|---|

Correlation andRegression – Partial andMultiple correlation- Multiple regression.

| Module:4 | Probability Distributions | 7hours | SLO: 1,7 |
|---|---|---|---|

Binomial and Poisson distributions – Normal distribution – Gamma distribution – Exponential distribution – Weibull distribution

| Module:5 | Hypothesis Testing I | 4hours | SLO: 2,7 |
|---|---|---|---|

| | | | |
|---|---|---|---|
| Testingofhypothesis–Introduction-Typesoferrors,criticalregion,procedureoftestinghypothesis-<br>Largesampletests-ZtestforSingleProportion,DifferenceofProportion,meananddifferenceof means. | | | |
| | | | |
| **Module:6** | **Hypothesis Testing II** | **9hours** | **SLO:** 1,7 |
| Smallsampletests-Student's t-test,F-test-chi-squaretest-goodnessoffit- independenceof attributes-DesignofExperiments-Analysisofvariance–oneandtwowayclassifications-CRD- RBD-LSD. | | | |
| | | | |
| **Module:7** | **Reliability** | **5hours** | **SLO:** 2,7 |
| Basic concepts- Hazard function-Reliabilities of series and parallel systems- System Reliability - Maintainability-Preventive and repairmaintenance-Availability. | | | |
| | | | |
| **Module:8** | **Contemporary Issues** | **2hours** | |
| Industry Expert Lecture | | | |
| | **Total Lecture hours:** | **45hours** | |

**TextBook(s)**

1. ProbabilityandStatisticsfor engineersand scientistsby R.E.Walpole, R.H.Mayers, S.L.Mayersand K.Ye, 9thEdition, PearsonEducation (2012).
2. DouglasC. Montgomery, George C. Runger, AppliedStatisticsandProbabilityfor

**Reference Books**

1. ReliabilityEngineering byE.Balagurusamy, Tata McGrawHill,Tenth reprint2010.
2. ProbabilityandStatisticsby J.L.Devore,8th Edition,Brooks/Cole, Cengage Learning (2012).
3. ProbabilityandStatisticsfor Engineersby R.A.Johnson, Miller &Freund's, 8th edition, Prentice Hall India (2011)

**Mode ofEvaluation**

Digital Assignments (Solutions by using soft skills), Continuous Assessment Tests, Quiz, Final

| **ListofChallenging Experiments (Indicative)** | | **SLO:** 1, 2, 7 |
|---|---|---|
| 1. | Introduction:UnderstandingData types; importing/exporting data. | 2hours |
| 2 | ComputingSummaryStatistics/plottingand visualizing data using | 2hours |
| 3. | Applyingcorrelationandsimple linear regressionmodel toreal dataset; | 2hours |
| 4. | Applyingmultiple linearregressionmodel to real dataset;computingand interpreting themultiple coefficientof determination | 2hours |
| 5. | Fitting thefollowing probabilitydistributions:Binomial distribution, | 2hours |
| 6. | Normal distributionPoissondistribution | 2hours |

| | | |
|---|---|---|
| 7. | Testingof hypothesisforOne samplemeanand proportionfromreal-time problems. | 2hours |
| 8. | Testingof hypothesisforTwo sample meanand proportionfromreal-time problems | 2hours |
| 9. | Applying thet testforindependentand dependentsamples | 2hours |
| 10. | ApplyingChi-square testfor goodnessof fittestandContingencytestto real dataset | 2hours |
| 11. | Performing ANOVA for real dataset forCompletelyrandomized design, Randomized Blockdesign,Latinsquare Design | 2hours |
| | Total LaboratoryHours | 22hours |

| | | | |
|---|---|---|---|
| **Mode of Evaluation:** | | | |
| Weekly Assessment, Final AssessmentTest | | | |
| RecommendedbyBoardofStudies | 25.02.2017 | | |
| Approvedby Academic Council | No. | Date | 16.03.2017 |

| Course code | Course Title | L | T | P | J | C |
|---|---|---|---|---|---|---|
| MGT1022 | Lean Start-up Management | 1 | 0 | 0 | 4 | 2 |
| Pre-requisite | None | Syllabus version | | | | |
| | | 1.0 | | | | |

**Course Objectives:**

- Learn the difference between traditional methods and Lean Start-up
- Explore Lean Start-up concepts, principles, and terminology
- Learn how "start-up" applies to both public products and internal company products
- Explore the Lean Start-up Model and the power of Visioning

**Expected Course Outcome:**

Students will be able to

- Learn the Use of Lean Analytics and Innovation Accounting to lead product development
- Understand experiment results to decide whether you should Pivot or Persevere

| Student Learning Outcomes (SLO): | 2,5,19 |
|---|---|

| | | | |
|---|---|---|---|
| **Module:1** | **Creativity and Design Thinking** | **2 hours** | **SLO: 2,5** |

Creativity and Design Thinking (identify the vertical for business opportunity, understand your customers, accurately assess market opportunity)

| | | | |
|---|---|---|---|
| **Module:2** | **Minimum Viable Product** | **3 hours** | **SLO: 2** |

Minimum Viable Product (Value Proposition, Customer Segments, Build-measure-learn process)

| | | | |
|---|---|---|---|
| **Module:3** | **Business Model Development** | **3 hours** | **SLO: 19** |

Business Model Development(Channels and Partners, Revenue Model and streams, Key Resources, Activities and Costs, Customer Relationships and Customer Development Processes, Business model canvas –the lean model- templates)

| | | | |
|---|---|---|---|
| **Module:4** | **Business Plan and Access to Funding** | **3 hours** | **SLO: 19** |

Business Plan and Access to Funding(visioning your venture, taking the product/ service to market, Market plan including Digital & Viral Marketing, start-up finance - Costs/Profits & Losses/cash flow, Angel/VC,/Bank Loans and Key elements of raising money)

| | | | |
|---|---|---|---|
| **Module:5** | **Legal and Regulatories** | **2 hours** | **SLO: 5,19** |

Legal, Regulatory, CSR, Standards, Taxes

| | | | |
|---|---|---|---|
| **Module:6** | **Contemporary issues : Lectures by Entrepreneurs** | **2hours** | **-** |
| | **Total Lecture hours:** | **15hours** | |

**Text Books**


1. The Startup Owner's Manual: The Step-By-Step Guide for Building a Great Company, Steve Blank, K & S Ranch; 1st edition (March 1, 2012).
2. The Four Steps to the Epiphany, Steve Blank, K&S Ranch; 2nd edition (July 17, 2013)
3. The Lean Startup: How Today's Entrepreneurs Use Continuous Innovation to Create Radically Successful Businesses, Eric Ries, Crown Business; (13 September 2011)


**Reference Books**

| | |
|---|---|
| 1. | Holding a Cat by the Tail, Steve Blank, K&S Ranch Publishing LLC (August 14, 2014) |
| 2. | Product Design and Development, Karal T Ulrich, SD Eppinger, McGraw Hill |
| 3. | Zero to One: Notes on Startups, or How to Build the Future, Peter Thiel, Crown Business; (16 September 2014) |
| 4. | Lean Analytics: Use Data to Build a Better Startup Faster (Lean Series), Alistair Croll & Benjamin Yoskovitz, O'Reilly Media; 1st Edition (March 21, 2013) |
| 5. | Inspired: How To Create Products Customers Love, Marty Cagan, SVPG Press; 1st edition (June 18, 2008) |

| | | | |
|---|---|---|---|
| Mode of evaluation: Internal Assessment Assignments; Field Trips, Case Studies; e-learning; Learning through research, TED Talks & FAT | | | |
| Recommended by Board of Studies | 15.12.2015 | | |
| Approved by Academic Council | 39th ACM | Date | 17.12.2015 |

| Course code | Engineering Physics | L | T | P | J | C |
|---|---|---|---|---|---|---|
| PHY1701 | | 3 | 0 | 2 | 0 | 4 |
| Pre-requisite | Physics of 12th standard or equivalent. | Syllabus version | | | | |
| | | 1.1 | | | | |

**Course Objectives:**

- Having an ability to apply mathematics and science in engineering applications [SLO 1]
- Having a clear understanding of the subject related concepts and of contemporary issues [SLO 2]
- Having Sense-Making Skills of creating unique insights in what is being seen or observed (Higher level thinking skills which cannot be codified) [SLO 4]

**Expected Course Outcome:**

Students will acquire the necessary knowledge about modernphysics and its applications in various engineering and technology disciplines.This course meets the following student outcomes

- anabilitytoapplyknowledgeof physics in engineering problems
- anabilitytodesignandconductexperiments,aswellastoanalyzeandinterpretdata
- anabilitytoidentify,formulate,andsolveengineeringproblems

**Student Learning Outcomes (SLO): 1,2,4**

| Module:1 | Introduction to Modern Physics | 6 hours | SLO: 1,2 |
|---|---|---|---|

Planck's concept (hypothesis), Compton Effect, Particle properties of wave: Matter Waves, Davisson Germer Experiment, Heisenberg Uncertainty Principle, Wave function, and Schrodinger equation (time dependent & independent).

| Module:2 | Applications of Quantum Physics | 5 hours | SLO: 1, 2 |
|---|---|---|---|

Particle in a 1-D box (Eigen Value and Eigen Function), 3-D Analysis (Qualitative), Tunneling Effect (Qualitative) (AB 205), Scanning Tunneling Microscope (STM).

| Module:3 | Nanophysics | 5 hours | SLO: 1 |
|---|---|---|---|

Introduction to Nano-materials, Moore's law, Properties of Nano-materials, Quantum confinement, Quantum well, wire & dot, Carbon Nano-tubes (CNT), Applications of nanotechnology in industry.

| Module:4 | Laser Principles and Engineering Application | 6 hours | SLO: 1,2 |
|---|---|---|---|

Laser Characteristics, Spatial and Temporal Coherence, Einstein Coefficient & its significance, Population inversion, Two, three & four level systems, Pumping schemes, Threshold gain coefficient, Components of laser, Nd-YAG, He-Ne, CO2 and Dye laser and their engineering applications.

| Module:5 | Electromagnetic Theory and its application | 6 hours | SLO: 2,4 |
|---|---|---|---|

Physics of Divergence, Gradient and Curl, Qualitative understanding of surface and volume integral, Maxwell Equations (Qualitative), Wave Equation (Derivation), EM Waves, Phase velocity, Group velocity, Group index , Wave guide (Qualitative)

| Module:6 | Propagation of EM waves in Optical fibers | 6 hours | SLO: 1 |
|---|---|---|---|

Light propagation through fibers, Acceptance angle, Numerical Aperture, Types of fibers - step index, graded index, single mode & multimode, Attenuation, Dispersion-intermodal and intramodal.

| Module:7 | Optoelectronic Devices & Applications of Optical fibers | 9 hours | SLO: 2,4 |
|---|---|---|---|

Sources-LED & Laser Diode, Detectors-Photodetectors- PN & PIN - Applications of fiber optics in

| | | | |
|---|---|---|---|
| communication- Endoscopy.<br>Special Theory of Relativity:<br>Frame of reference, Galilean relativity, Postulate of special theory of relativity, Simultaneity, length contraction and time dilation. | | | |
| | | | |
| **Module:8** | **Contemporary issues:** | **2 hours** | |
| Lecture by Industry Experts | | | |
| | | | |
| | **Total Lecture hours:** | **45 hours** | |

| **Text Book(s)** | |
|---|---|
| 1. | Arthur Beiser et al., Concepts of Modern Physics, 2013, Sixth Edition, Tata McGraw Hill. |
| 2. | William Silfvast, Laser Fundamentals, 2008, Cambridge University Press. |
| 3. | D. J. Griffith, Introduction to Electrodynamics, 2014, 4th Edition, Pearson. |
| 4. | Djafar K. Mynbaev and Lowell L.Scheiner, Fiber Optic Communication Technology, 2011, Pearson. |

| **Reference Books** | |
|---|---|
| 1. | Raymond A. Serway, Clement J. Mosses, Curt A. Moyer Modern Physics, 2010, 3rd Indian Edition Cengage learning. |
| 2. | John R. Taylor, Chris D. Zafiratos and Michael A. Dubson, Modern Physics for Scientists and Engineers, 2011, PHI Learning Private Ltd. |
| 3. | Kenneth Krane Modern Physics, 2010, Wiley Indian Edition. |
| 4. | Nityanand Choudhary and Richa Verma, Laser Systems and Applications, 2011, PHI Learning Private Ltd. |
| 6. | S. Nagabhushana and B. Sathyanarayana, Lasers and Optical Instrumentation, 2010, I.K. International Publishing House Pvt. Ltd., |
| 7. | R. Shevgaonkar, Electromagnetic Waves, 2005, 1st Edition, Tata McGraw Hill |
| 8. | Principles of Electromagnetics, Matthew N.O. Sadiku, 2010,Fourth Edition, Oxford. |
| 9. | Ajoy Ghatak and K. Thyagarajan, Introduction to Fiber Optics, 2010, Cambridge University Press. |

**Mode of Evaluation:** Quizzes , Digital Assignments, CAT-I and II and FAT

| **List of Challenging Experiments (Indicative)** | | **SLO:14,17** |
|---|---|---|
| 1. | Determination of Planck's constant using electroluminescence process (Module 1) | 2 hours |
| 2. | Electron diffraction (Module 1) | 2 hours |
| 3. | Determination of wavelength of laser source (He -Ne laser and diode lasers of different wavelengths) using diffraction technique (Module 4 ) | 2 hours |
| 4. | Dispersive power of prism (Module 6) | 2 hours |
| 5. | Optical Fiber communication (source + optical fiber + detector) (Modules 7+8) | 2 hours |
| 6. | Determination of size of fine particle using laser diffraction (Module 3) | 2 hours |
| 7. | Determination of the track width (periodicity) in a written CD (Module 4) | 2 hours |
| 8. | PIN diode characteristics (Module 8) | 2 hours |

| | | |
|---|---|---|
| 9. | Black body Radiation (Module 1+2) | 2 hours |
| 10. | Optical Fiber communication (source + optical fiber + detector) (Modules 7 + 8) | 2 hours |
| 11. | Analysis of crystallite size and strain in a nano -crystalline film using X-ray diffraction (Module 3) | 2 hours |
| 12. | Numerical solutions of Schrödinger equation (e.g. particle in a box problem) (Module 2) (can be given as an assignment) | 2 hours |
| 13. | Laser coherence length measurement (Module 4) | 2 hours |
| 14. | Proof for transverse nature of E.M. waves (Module 6) | 2 hours |
| 15. | Quantum confinement and Heisenberg's uncertainty principle (Module 1 + 3) | 2 hours |
| | Total Laboratory Hours | 30 hours |

| | | | |
|---|---|---|---|
| Recommended by Board of Studies | 11.08.2017 | | |
| Approved by Academic Council | No. | Date | |

| Course code | Introduction to Innovative Projects | L | T | P | J | C |
|---|---|---|---|---|---|---|
| PHY1999 | | 1 | 0 | 0 | 4 | 2 |
| Pre-requisite | | Syllabus version | | | | |
| | | 1.00 | | | | |

**Course Objectives:**

- To make students confident enough to handle the day to day issues.
- To develop the "Thinking Skill" of the students, especially Creative Thinking Skills
- To train the students to be innovative in all their activities
- To prepare a project report on a socially relevant theme as a solution to the existing issues

**Expected Course Outcome:**

- The students would have completed preparation of a proposal on a socially relevant project, with innovative solution incorporated in it.

**Student Learning Outcomes (SLO):** **2,4,5,9,11,12,16,18**

| Module:1A | | 5 hours | SLO: 4 |
|---|---|---|---|

**Self Confidence :** Understanding self – Johari Window – SWOT Analysis – Self Esteem – Being a contributor – Case Study

**Project :** Exploring self, understanding surrounding, thinking about how s(he) can be a contributor for the society, Creating a big picture of being an innovator – writing a 1000 words imaginary autobiography of self – Topic "Mr X – the great innovator of 2015" and upload

| Module:1B | | 5 hours | SLO: 5,4,9 |
|---|---|---|---|

**Thinking Skill :** Thinking and Behaviour – Types of thinking – Concrete – Abstract,Convergent, Divergent, Creative, Analytical, Sequential and Holistic thinking – Chunking Triangle – Context Grid – Examples – Case Study.

**Project :** Meeting atleast 50 people belonging to various strata of life and talk to them to identify a min of 100 society related issues, problems for which they need solutions and categorise them and upload along with details of people met and lessons learnt.

| Module:1C | | 5 hours | SLO: 5 |
|---|---|---|---|

**Lateral Thinking Skill:** Blooms Taxonomy – HOTS – Out of the box thinking – deBono lateral thinking model – Examples

**Project :** Last weeks - incomplete portion to be done and Uploaded

| Module:2A | | 5 hours | SLO: 2 |
|---|---|---|---|

**Creativity :** Creativity Models – Walla – Barrons – Koberg & Begnall – Examples

**Project :** Selecting 5 out of 100 issues identified for future work. Criteria based approach for prioritisation, use of statistical tools & upload

| Module:2B | | 5 hours | SLO: 11 |
|---|---|---|---|

**Brainstorming :** 25 brainstorming techniques and examples

**Project :** Brainstorm and come out with as many solutions as possible for the top 5 issues identified & upload

| Module:3A | | 5 hours | SLO: 4 |
|---|---|---|---|

**Mind Mapping:** Mind Mapping techniques and guidelines. Drawing a mind map

**Project :** Using Mind Maps get another set of solutions for the next 5 issues (issue 6 – 10)

| Module:4A | | 5 hours | SLO: 12 |
|---|---|---|---|

| | | | |
|---|---|---|---|
| **Systems thinking :** Systems Thinking essentials – examples – Counter Intuitive condemns | | | |
| **Project :** Select 1 issue / problem for which the possible solutions are available with you. Apply Systems Thinking process and pick up one solution [explanation should be given why the other possible solutions have been left out ]. Go back to the customer and assess the acceptability and upload. | | | |
| | | | |
| **Module:4B** | | **5 hours** | **SLO: 5,12** |
| **Design Thinking:** Design thinking process – Human element of design thinking – case study | | | |
| **Project :** Apply design thinking to the selected solution, apply the engineering & scientific tinge to it. Participate in "design week" celebrations upload the weeks learning out come. | | | |
| | | | |
| **Module:5A** | | **5 hours** | **SLO: 18** |
| **Innovation :** Difference between Creativity and Innovation – Examples of innovation –Being innovative | | | |
| **Project:** A literature searches on prototyping of your solution finalized. Prepare a prototype model or process and upload. | | | |
| | | | |
| **Module:5B** | | **5 hours** | **SLO: 19** |
| **Blocks for Innovation:** Identify Blocks for creativity and innovation – overcoming obstacles – Case Study | | | |
| **Project :** Project presentation on problem identification, solution, innovations-expected results – Interim review with PPT presentation. | | | |
| | | | |
| **Module:5C** | | **5 hours** | **SLO: 12** |
| **Innovation Process:** Steps for Innovation – right climate for innovation | | | |
| **Project:** Refining the project, based on the review report and uploading the text. | | | |
| | | | |
| **Module:6A** | | **5 hours** | **SLO: 2** |
| **Innovation in India :** Stories of 10 Indian innovations | | | |
| **Project:** Making the project better with add ons | | | |
| | | | |
| **Module:6B** | | **5 hours** | **SLO: 9** |
| **JUGAAD Innovation :** Frugal and flexible approach to innovation - doing more with less Indian Examples | | | |
| **Project:** Fine tuning the innovation project with JUGAAD principles and uploading (Credit for JUGAAD implementation) | | | |
| | | | |
| **Module:7** | | **5 hours** | **SLO: 16** |
| **Innovation Project Proposal Presentation:** Project proposal contents, economic input, ROI – Template | | | |
| **Project:** Presentation of the innovative project proposal and upload | | | |
| | | | |
| **Module:8** | | **5 hours** | **SLO: 2** |
| Contemporary issue in Innovation | | | |
| **Project:** Final project Presentation , Viva voce Exam | | | |
| | | | |
| | **Total Lecture hours:** | **75 hours** | |
| **Text Book(s)** | | | |

| | |
|---|---|
| 1. | How to have Creative Ideas, Edward debone, Vermilon publication, UK, 2007 |
| 2. | The Art of Innovation, Tom Kelley & Jonathan Littman, Profile Books Ltd, UK, 2008 |
| **Reference Books** | |
| 1. | Creating Confidence, Meribeth Bonct, Kogan Page India Ltd, New Delhi, 2000 |
| 2. | Lateral Thinking Skills, Paul Sloane, Keogan Page India Ltd, New Delhi, 2008 |
| 3. | Indian Innovators, Akhat Agrawal, Jaico Books, Mumbai, 2015 |
| 4. | JUGAAD Innovation, Navi Radjou, Jaideep Prabhu, Simone Ahuja Random house India, Noida, 2012. |

| | | | |
|---|---|---|---|
| Recommended by Board of Studies | DD-MM-YYYY | | |
| Approved by Academic Council | No. xx | Date | DD-MM-YYYY |

| ESP1001 | ESPAÑOL FUNDAMENTAL (Fundamental Spanish) | L | T | P | J | C |
|---|---|---|---|---|---|---|
| | | 2 | 0 | 0 | 0 | 2 |
| **Pre-requisite** | **NIL** | | | | | **Syllabus version** |
| **Anti-requisite** | NIL | | | | | 1.0 |

**Course Objectives:**

This course is designed to introduce Spanish through a study of the Language with special focus on the cultural aspects.

**Expected Course Outcome:**

- Having interest in lifelong learning.
- Having adaptive thinking and adaptability.
- Having a good working knowledge of communicating in Spanish.
- Having critical thinking and innovative skills

| **Student Learning Outcomes (SLO):** | **11,12,16,18** |
|---|---|

| **Module:1** | | **3hours** | **SLO: 11,12** |
|---|---|---|---|

Abecedario, Saludos y Datos personales: Origen, Nacionalidad, Profesión

**Competencia Gramática:** Vocales y Consonantes. Artículos definidos e indefinidos (Numero y Genero).

**Competencia Escrita:** Saludos y Datos personales

| **Module:2** | | **3 hours** | **SLO: 11,12** |
|---|---|---|---|

Edad y posesión. Números (1-20)

**Competencia Gramática:** Pronombres personales. Adjetivos. Los verbos SER y TENER.

**Competencia Escrita:** Escribe sobre mismo/a y los compañeros de la clase

| **Module:3** | | **5 hours** | **SLO: 11,12** |
|---|---|---|---|

Vocabulario de Mi habitación. Colores. Descripción de lugares y cosas.

**Competencia Gramática:** Adjetivos posesivos. El uso del verbo ESTAR. Diferencia entre SER y ESTAR.

**Competencia Escrita:** Mi habitación

| **Module:4** | | **4 hours** | **SLO: 11,12** |
|---|---|---|---|

Mi familia. Números (21-100). Direcciones. Expresar la hora. Los meses del año.

**Competencia Gramática:** Frases preposicionales. Uso del HAY. La diferencia entre MUY y MUCHO. Uso del verbo GUSTAR

**Competencia Escrita:** Mi familia. Dar opiniones sobre tiempo

| **Module:5** | | **5 hours** | **SLO: 11,12** |
|---|---|---|---|

Expresar fechas y el tiempo. Dar opiniones sobre personas y lugares.

| | | | |
|---|---|---|---|
| **Competencia Gramática:** Los verbos regulares (-AR, -ER, -IR) en el presente. Adjetivos demostrativos.<br>**Competencia Escrita:** Mi mejor amigo/a. Expresar fechas. Traducción ingles a español y Español a Ingles. | | | |
| | | | |
| **Module:6** | | **3 hours** | **SLO: 11,12,16,18** |
| Describir el diario. Las actividades cotidianas.<br>**Competencia Gramática:** Los Verbos y pronombres reflexivos. Los verbos pronominales con e/ie, o/ue, e/i, u/ue.<br>**Competencia Escrita:** El horario. Traducción ingles a español y Español a Ingles. | | | |
| | | | |
| **Module:7** | | **5 hours** | **SLO: 11,12,16,18** |
| Dar opiniones sobre comidas y bebidas. Decir lo que está haciendo.Describir mi ciudad y Ubicar los sitios en la ciudad.<br>**Competencia Gramática:** Los verbos irregulares. Estar + gerundio. Poder + Infinitivo.<br>**Competencia Escrita:** Conversación en un restaurante. Traducción ingles a español y Español a Ingles.Mi ciudad natal. Mi Universidad. La clase.Mi fiesta favorita. | | | |
| | | | |
| **Module:8** | **Contemporary issues/ Native speaker** | **2 hours** | |
| | | | |
| | **Total Lecture hours:** | **30 hours** | |

| **Text Book(s)** | |
|---|---|
| 1. | Aula Internacional 1", Jaime Corpas, Eva Garcia, Agustin Garmendia, Carmen Soriano Goyal Publication ; reprinted Edition, (2010) |
| | |

| **Reference Books** | |
|---|---|
| 1. | "¡AcciónGramática!", Phil Turk and Mike Zollo, Hodder Murray, London 2006. |
| 2. | "Practice makes perfect: Spanish Vocabulary", Dorothy Richmond, McGraw Hill Contemporary, USA, 2012. |
| 3. | "Practice makes perfect: Basic Spanish", Dorothy Richmond, McGraw Hill Contemporary, USA 2009. |
| 4. | "Pasaporte A1 Foundation", Matilde Cerrolaza Aragón, Óscar Cerrolaza Gili, Begoña Llovet Barquero, Edelsa Grupo, España , 2010 |
| | |

| | | | |
|---|---|---|---|
| Recommended by Board of Studies | YES | | |
| Approved by Academic Council | 41st Academic council | Date | 17.06.2016 |

| ESP2001 | ESPAÑOL INTERMEDIO (Intermediate Spanish) | L | T | P | J | C |
|---|---|---|---|---|---|---|
| | | 2 | 0 | 2 | 0 | 3 |
| **Pre-requisite** | Basic Spanish or Basic level course done from recognized institute.(ESP101/ESP1001) | | | | | **Syllabus version** |
| **Anti-requisite** | | | | | | 1.0 |

**Course Objectives:**

- To enhance learners writing skills in Spanish.
- To help learners in vocabulary acquisition.
- To develop learners' communication skills through various language activities and innovative methods.

**Expected Course Outcome:**

- Having interest in lifelong learning.
- Having adaptive thinking and adaptability.
- Having a good working knowledge of communicating in Spanish.
- Having critical thinking and innovative skills

| **Student Learning Outcomes (SLO):** | **11,12,16,18** |
|---|---|

| **Module:1** | | **3hours** | **SLO: 11,12,16** |
|---|---|---|---|

Numeros (101 – 1 millón). Expresar los planes futuros. Los números ordinales.
Competencia Gramática: Futuros cercanos (Ir+a+Infinitivo). Futuros (Verbos regulares e irregulares).Uso del POR y PARA.
Competencia Escrita: Traducción ingles a español y Español a Ingles.
Comprensión - Los textos y Videos

| **Module:2** | | **3 hours** | **SLO: 11,12,16** |
|---|---|---|---|

Las ropas, colores y tamaños. Costar, valer, descuentos y rebajas
Competencia Gramática: Pronombres objetivos directos e indirectos. El verbo Gustar y Disgustar.
Competencia Escrita: Traducción ingles a español y Español a Ingles. Comprensión - Los textos y Videos

| **Module:3** | | **5 hours** | **SLO: 11,12,16** |
|---|---|---|---|

Escribir un Correo electrónico formal e informal.
Competencia Gramática: Imperativos formales e informales. Pretérito perfecto.
Competencia Escrita: Traducción ingles a español y Español a Ingles.
Comprensión - Los textos y Videos

| **Module:4** | | **4 hours** | **SLO: 11,12,16** |
|---|---|---|---|

Currículo Vitae. Presentarse en una entrevista informal.
Competencia Gramática: Pretérito imperfecto. Pretérito indefinido.
Competencia Escrita: Traducción ingles a español y Español a Ingles.
Comprensión - Los textos y Videos

| | | | |
|---|---|---|---|
| **Module:5** | | **5 hours** | **SLO: 11,12,16,18** |
| Comprensión oral: Introducción personal, Expresar los planes futuros. ¿Qué vas a hacer en las próximas vacaciones?<br>Comprensión auditiva: Las preguntas sobre un cuento auditivo. Relacionar el audio con las imágenes. Las preguntas basadas en canciones.<br>Medio de transporte: Comprar y Reservar billetes. | | | |
| | | | |
| **Module:6** | | **3 hours** | **SLO: 11,12,16,18** |
| Comprensión oral: Diálogos entre dos (cliente y tendero de ropas, pasajero y empleado, en un restaurante, Reservación de habitación en un hotel). Presentación en una entrevista.<br>Comprensión auditiva: Las preguntas basadas en canciones. Las preguntas basadas en diálogos. | | | |
| | | | |
| **Module:7** | | **5 hours** | **SLO: 11,12,16,18** |
| Comprensión oral: Dialogo entre un médico y paciente. Presentación de los países hispánicos. Describir su infancia. Describir vacaciones últimasolas actividades de último fin de semana.<br>Comprensión auditiva: Rellenar los blancos del cuento en pasado. Las preguntas basadas en el cuento. Las preguntas basadas en un anuncio | | | |
| | | | |
| **Module:8** | **Contemporary issues/ Native speaker** | **2 hours** | |
| | | | |
| | **Total Lecture hours:** | **30 hours** | |

| | |
|---|---|
| **Text Book(s)** | |
| 1. | Aula Internacional 1", Jaime Corpas, Eva Garcia, Agustin Garmendia, Carmen Soriano Goyal Publication ; reprinted Edition, (2010) |
| | |
| **Reference Books** | |
| 1. | '"¡AcciónGramática!", Phil Turk and Mike Zollo, Hodder Murray, London 2006. |
| 2. | "Practice makes perfect: Spanish Vocabulary", Dorothy Richmond, McGraw Hill Contemporary, USA, 2012. |
| 3. | "Practice makes perfect: Basic Spanish", Dorothy Richmond, McGraw Hill Contemporary, USA 2009. |
| 4. | "Pasaporte A1 Foundation", Matilde Cerrolaza Aragón, Óscar Cerrolaza Gili, Begoña Llovet Barquero, Edelsa Grupo, España , 2010 |
| | |

| List of Challenging Experiments (Indicative) | | SLO: |
|---|---|---|
| 1. | To give an oral presentation in Spanish on any Hispanic country | 12, 18 |
| 2. | To perform a role play in Spanish | 11, 12, 16 |
| 3. | To describe a short video on festival of Spain in Spanish | 11, 12, 18 |
| 4. | To give answers of the question after listening the audio file | 11, 12, 16 |
| 5. | To give answers of the question after watching conversation video clip | 12, 16, 18 |
| 6. | To describe their family members in Spanish | 12, 16, 18 |
| 7. | To describe themselves and their daily routine in Spanish | 11, 18 |

| | | | |
|---|---|---|---|
| Recommended by Board of Studies | YES | | |
| Approved by Academic Council | 41st Academic council | Date | 17.06.2016 |

| GER1001 | GRUNDSTUFE DEUTSCH (Basic German) | L | T | P | J | C |
|---|---|---|---|---|---|---|
| | | 2 | 0 | 0 | 0 | 2 |
| **Pre-requisite** | **NIL** | | | | | **Syllabus version** |
| **Anti-requisite** | | | | | | 1.0 |

**Course Objectives:**

This course is designed to introduce German through a study of Language with special focus on the cultural aspects.

**Expected Course Outcome:**

- Having interest in lifelong learning.
- Having adaptive thinking and adaptability.
- Having a good working knowledge of communicating in German.
- Having critical thinking and innovative skills

| **Student Learning Outcomes (SLO):** | **11,12,16,18** |
|---|---|

| **Module:1** | | **3hours** | **SLO: 11,12** |
|---|---|---|---|

Begrüssung, Landeskunde, Alphabet, Personalpronomen, Verben- heissen, kommen,wohnen, lernen,Zahlen (1-100), W-Fragen, Aussagesätze, Nomen- Singular und Plural, der Artikel - Bestimmter- UnbestimmterArtikel)
Lernziel :
Sichvorstellen, GrundlegendesVerständnisvon Deutsch, Deutschland in Europa

| **Module:2** | | **3 hours** | **SLO: 11,12** |
|---|---|---|---|

Konjugation derVerben(regelmässig /unregelmässig),dasJahr- Monate, Jahreszeitenund die Woche, Hobbys, Berufe, Artikel, Zahlen (Hundert bis eine Million), Ja-/Nein- Frage, Imperativ mit ,,Sie''
Lernziel:
Sätzeschreiben, über Hobbys, Berufeerzählen, usw.

| **Module:3** | | **5 hours** | **SLO: 11,12** |
|---|---|---|---|

Possessivpronomen, Negation, Kasus (Bestimmter- UnbestimmterArtikel) Trennbareverben, Modalverben, Uhrzeit, Präpositionen, Lebensmittel, Getränkeund Essen, Farben, Tiere
Lernziel :
Sätze mit Modalverben, VerwendungvonArtikel, AdjektivbeimVerb

| **Module:4** | | **4 hours** | **SLO: 11,12** |
|---|---|---|---|

Übersetzung: (Deutsch – Englisch / Englisch – Deutsch)
Lernziel :
Die Übungvon Grammatik und Wortschatz

| **Module:5** | | **5 hours** | **SLO: 11,12** |
|---|---|---|---|

Leserverständnis. Mindmapmachen, Korrespondenz- Briefe und Email
Lernziel:
Übung der Sprache, Wortschatzbildung.

| | | | |
|---|---|---|---|
| **Module:6** | | **3 hours** | **SLO: 11,12,16** |
| Aufsätze :<br>Die Familie, Bundesländer in Deutschland, EinFest in Deutschland,<br>Lernziel :<br>Aktiver, selbständigerGebrauch der Sprache | | | |
| | | | |
| **Module:7** | | **5 hours** | **SLO: 11,12,16,18** |
| Dialoge:<br>a) Gespräche mit einem/einer Freund /Freundin.<br>b) GesprächebeimEinkaufen ; in einemSupermarkt ; in einerBuchhandlung ;<br>c) in einemHotel - an der Rezeption ; einTerminbeimArzt.<br>d) Ein Telefongespräch ; Einladung–Abendessen | | | |
| | | | |
| **Module:8** | **Contemporary issues/ Native speaker** | **2 hours** | |
| | | | |
| | **Total Lecture hours:** | **30 hours** | |

| **Text Book(s)** | |
|---|---|
| 1. | Netzwerk Deutsch alsFremdsprache A1, Stefanie Dengler, Paul Rusch, Helen Schmtiz, Tanja Sieber, Klett-LangenscheidtVerlag, München : 2013 |
| | |

| **Reference Books** | |
|---|---|
| 1. | Lagun, HartmutAufderstrasse, Jutta Müller, Thomas Storz, 2012. |
| 2. | Studio d A1, Hermann Funk, Christina Kuhn, CorneslenVerlag, Berlin :2010 |
| 3. | Deutsche Sprachlehrefür Ausländer, Heinz Griesbach, Dora Schulz, 2013 |
| 4. | TangramAktuell-I, Maria-Rosa, SchoenherrTil, Max Hueber Verlag, Muenchen :2012 |
| | |

| | | | |
|---|---|---|---|
| Recommended by Board of Studies | YES | | |
| Approved by Academic Council | 41st Academic council | Date | 17.06.2016 |

| GER2001 | MITTELSTUFE DEUTSCH (INTERMEDIATE GERMAN) | L | T | P | J | C |
|---|---|---|---|---|---|---|
| | | 2 | 0 | 2 | 0 | 3 |

| Pre-requisite | Grundstufe Deutsch (GER1001) or GER101 | Syllabus version |
|---|---|---|
| Anti-requisite | NIL | `1.0 |

**Course Objectives:**

- To enhance learners writing skills in German.
- To help learners in vocabulary acquisition.
- To develop learners' communication skills through various language activities and innovative methods.

**Expected Course Outcome:**

- Having interest in lifelong learning.
- Having adaptive thinking and adaptability.
- Having a good working knowledge of communicating in German.
- Having critical thinking and innovative skills

| Student Learning Outcomes (SLO): | 11,12,16,18 |
|---|---|

| Module:1 | | 9 hours | SLO: 11,12 |
|---|---|---|---|

Grammatik : Tempus- Perfekt, Präteritum, Plusquamperfekt, Futur-I, Futur-II, Wiederholung der Grundstufengrammatik
**Lernziel :** SätzeschreibenverschiedenenZeiten.

| Module:2 | | 7 hours | SLO: 11,12 |
|---|---|---|---|

Grammatik : Passiv, Personalpronomen (Nominativ, Akkusativ, Dativ)
**Lernziel:** Passiv, Formen des Personalpronomens

| Module:3 | | 7 hours | SLO: 11,12 |
|---|---|---|---|

Adjektivdeklination,Nebensatz,Präpositionen mit AkkusativundDativ, InfinitivSätze
**Lernziel:** VerbindungzwischenAdjektivbeimNomen,

| Module:4 | | 5 hours | SLO: 11,12,16 |
|---|---|---|---|

Übersetzung :Technische Terminologie, wissenschaftliche, literarischeTexte ausdemDeutscheninsEnglischeundumgekehrt,
**Lernziel :** Übungvon Grammatik undWortschatz

| Module:5 | | 5 hours | SLO: 11,12,16,18 |
|---|---|---|---|

HörverständnisdurchAudioübung :Familie, Leben in Deutschland, Am Bahnhof,
Videos : Politik, Historie, Tagesablauf in einemanderenStadt,
**Lernziel** : Übung der Sprache

| Module:6 | | 5 hours | SLO: 11,12,16,18 |
|---|---|---|---|

HörverständnisdurchAudioübung: ÜberberühmtePersönlichkeiten, Feste in Deutschland,
Videos :Wetter, An der Universität,ein Zimmer buchen, Studentenleben,StädteundLandeskunde

| | | | |
|---|---|---|---|
| **Lernziel** : Hörverständnis, Landeskunde | | | |
| | | | |
| **Module 7** | | **5 hours** | **SLO: 11,12,16,18** |
| HörverständnisdurchAudioübung: FM RadioausDeutschland<br>Videos: FernseherausDeutschland<br>**Lernziel** : LSRWFähigkeiten | | | |
| **Module 8** | **Contemporary Discussions** | **2 hours** | |
| | | | |
| | **Total Lecture hours:** | **45 hours** | |

| | |
|---|---|
| **Text Book(s)** | |
| 1 | TangramAktuell II, Rosa Maria Dallapizza, Beate Blüggel, Max Hueber Verlag ,München : 2010 |
| **Reference Books** | |
| 1 | ThemenAktuell, Heiko Bock, Mueller Jutta, MaxHueberVerla, Muenchen : 2010 |
| 2 | Deutsch SprachlehrefuerAuslaender, Schulz Griesbach, Max Hueber Verlag, Muenchen : 2012 |
| 3 | Lagune, Deutsch alsFremdsprache, Jutta Müller, Storz Thomas, Hueber Verlag, Ismaning : 2013 |
| 4 | Studio d A1, Hermann Funk, Christina Kuhn, Max HuerberVerlag, München : 2011 |
| | **Website address :-** www.goethe.de; wirtschaftsdeutsch.de ; hueber.de ; klett-sprachen.de ; www.deutschtraning.org; https://bpb.de/lernen |

| | | |
|---|---|---|
| **List of Challenging Experiments (Indicative)** | | **SLO :** |
| 1. | Different types of Verbs for 72 hours | 11,12 |
| 2. | Identifying Nouns and its genders for 72 hours | 11,12 |
| 3. | Listening to the conversation in Radio and analysing the Tenses | 11,12,16 |
| 4. | Audio files on role model for 20 minutes | 12,16 |
| 5. | Write up on Climate change and water conservation | 18 |
| 6. | Audio files on self-introduction for 20 minutes | 12,16 |
| 7. | Comprehension of a paragraph from German Newspaper | 11,12,18 |

| | | | |
|---|---|---|---|
| Recommended by Board of Studies | YES | | |
| Approved by Academic Council | 41st Academic council | Date | 17.06.2016 |

| FRE1001 | FRANÇAIS QUOTIDIEN (BASIC FRENCH) | L | T | P | J | C |
|---|---|---|---|---|---|---|
| | | 2 | 0 | 0 | 0 | 2 |
| **Pre-requisite** | **NIL** | **Syllabus version** | | | | |
| **Anti-requisite** | **NIL** | 1.0 | | | | |

**Course Objectives:**

- This course is designed to introduce French through a study of Language with special focus on the cultural aspects.

**Expected Course Outcome:**

- Having interest in lifelong learning.
- Having adaptive thinking and adaptability.
- Having a good working knowledge of communicating in French
- Having critical thinking and innovative skills

| **Student Learning Outcomes (SLO):** | **11,12,16,18** |
|---|---|

| **Module:1** | | **3 hours** | **SLO: 11,12** |
|---|---|---|---|

Les Salutations, Les nombres (1-100), Les jours de la semaine, Les mois de l'année, Les Pronoms Sujets, Les Pronoms Toniques, La conjugaison des verbes irréguliers- avoir / être / aller / venir / faire etc.
Savoir-faire pour:
Saluer, Se présenter, Présenter quelqu'un, Etablir des contacts

| **Module:2** | | **3 hours** | **SLO: 11,12** |
|---|---|---|---|

La conjugaison des verbes réguliers, La conjugaison des verbes pronominaux, La Négation, L'interrogation avec 'Est-ce que ou sans Est-ce que'.
Savoir-faire pour:
Chercher un(e) correspondant(e), Demander des nouvelles d'une personne.

| **Module:3** | | **6 hours** | **SLO: 11,12** |
|---|---|---|---|

La Nationalité du Pays, L'article (défini/ indéfini), Les prépositions (à/en/au/aux/sur/dans/avec etc.), L'article contracté, Les heures en français, L'adjectif (La Couleur, L'adjectif possessif, L'adjectif démonstratif/ L'adjectif interrogatif (quel/quelles/quelle/quelles), L'accord des adjectifs avec le nom, L'interrogation avec Comment/ Combien / Où etc.
Savoir-faire pour:
Poser des questions, Dire la date et les heures en français,

| **Module:4** | | **4 hours** | **SLO: 11,12** |
|---|---|---|---|

La traduction simple :(français-anglais / anglais –français),
Savoir-faire pour :
Faire des achats, Comprendre un texte court, Demander et indiquer le chemin.

| **Module:5** | | **5 hours** | **SLO: 11,12,16** |
|---|---|---|---|

L'article Partitif, Mettez les phrases aux pluriels, Faites une phrase avec les mots donnés, Trouvez les questions.

Savoir-faire pour :

Répondez aux questions générales en français, Exprimez les phrases données au Masculin ou au Féminin, Associez les phrases.

| | | | |
|---|---|---|---|
| **Module:6** | | **3 hours** | **SLO: 11,12,16** |
| Décrivez :<br>La Famille / La Maison / L'université /Les Loisirs/ La Vie quotidienne etc. | | | |
| **Module 7** | | **4 hours** | **SLO: 11,12,16,18** |
| **Dialogue**<br>a) Décrire une personne.<br>b) Des conversations à la cafeteria.<br>c) Des conversations avec les membres de la famille<br>d) Des dialogues entre les amis. | | | |
| **Module 8** | **Contemporary Discussion** | **2 hours** | |
| | | | |
| | **Total Lecture hours:** | **30 hours** | |

| **Text Book(s)** | |
|---|---|
| 1 | Fréquence jeunes-1, Méthode de français, G. Capelle et N.Gidon, Hachette, Paris, 2010. |
| 2 | Fréquence jeunes-1, Cahier d'exercices, G. Capelle et N.Gidon, Hachette, Paris, 2010. |

| **Reference Books** | |
|---|---|
| 1 | CONNEXIONS 1, Méthode de français, Régine Mérieux, Yves Loiseau, Les Éditions Didier, Paris 2010. |
| 2 | CONNEXIONS 1, Le cahier d'exercices, Régine Mérieux, Yves Loiseau, Les Éditions Didier, Paris 2010. |
| 3 | ALTER EGO 1, Méthode de français, Annie Berthet, Catherine Hugo, Véronique M. Kizirian, Béatrix Sampsonis, Monique, Waendendries, Hachette livre Paris 2011 |
| 4 | ALTER EGO 1, Le cahier d'activités, Annie Berthet, Catherine Hugo, Béatrix Sampsonis, Monique Waendendries , Hachette livre, Paris 2011 |

| | | | |
|---|---|---|---|
| | | | |
| Recommended by Board of Studies | Yes | | |
| Approved by Academic Council | 41st Academic council | Date | 17.06.2016 |

| FRE2001 | FRANÇAIS PROGRESSIF (PROGRESSIVE FRENCH) | L | T | P | J | C |
|---|---|---|---|---|---|---|
| | | 2 | 0 | 2 | 0 | 3 |
| **Pre-requisite** | **FRE101/FRE1001** | **Syllabus version** | | | | |
| **Anti-requisite** | **NIL** | 1.0 | | | | |

**Course Objectives:**

- To enhance learners writing skills in French
- To help learners in vocabulary acquisition.
- To develop learners' communication skills through various language activities and innovative methods.

**Expected Course Outcome:**

- Having interest in lifelong learning.
- Having adaptive thinking and adaptability.
- Having a good working knowledge of communicating in French.
- Having critical thinking and innovative skills

| **Student Learning Outcomes (SLO):** | **11,12,16,18** |
|---|---|

| **Module:1** | | **8 hours** | **SLO: 11,12** |
|---|---|---|---|

La vie quotidiennes - Le verbe pronominal - Le passé composé avec l'auxiliaire - avoir et être- le passé récent: venir de + infinitif - Le comparatif - Le superlatif - Les mots interrogatifs (les trois formes)

**Savoir-faire pour** : Faire des achats, faire des commandes dans un restaurant, poser des questions.

| **Module:2** | | **6 hours** | **SLO: 11,12** |
|---|---|---|---|

La vie privée et publique (Les achats, Les voyages, les transports-La nourriture, etc.) - Les lieux de la ville - Les mots du savoir-vivre - Les pronoms indéfinis - Les pronoms démonstratifs - Les pronoms compléments objets directs/ indirects - La formation du future simple et future proche

**Savoir-faire pour :**Réserver les billets pour le voyage, réserver les chambres dans un hôtel, S'informer sur les lieux de la ville, indiquer la direction à un étranger.

| **Module:3** | | **7 hours** | **SLO: 11,12** |
|---|---|---|---|

Les loisirs (sports/spectacles/activités) - Les moments de la journée, de l'année- La fête indienne et française – Les goûts - L'impératif - La négation de l'impératif-La place du pronom à l'impératif avec un verbe pronominal.

**Savoir-faire pour :** Parler de ses goûts, raconter les vacances, formuler des phrases plus compliquées, Raconter les souvenirs de l'enfance, parler sur la tradition de son pays natal.

| **Module:4** | | **7 hours** | **SLO: 11,12,16** |
|---|---|---|---|

L'espace francophone - Première approche de la société française – La consommation alimentaire – caractériser un objet – décrire une tenue - Le pronom relatif (qui/que/dont/où)

**Savoir-faire pour :**

Articles de la presse-Portrait d'une personne-Cartes et messages d'invitation, d'acceptation

| | | | |
|---|---|---|---|
| ou de refus -Article de presse - rédaction d'un événement. | | | |
| | | | |
| **Module:5** | | **5 hours** | **SLO: 11,12,16,18** |
| Parler de ses activités quotidiennes - les fêtes en France – Parler de sa famille – réserver un billet à l'agence - la gastronomie française | | | |
| | | | |
| **Module:6** | | **5 hours** | **SLO: 11,12,16,18** |
| Décrire physiquement une personne – les vacances – les achats – réserver une chambre dans un hôtel – les plus grands français - raconter des évènements passés | | | |
| **Module 7** | | **5 hours** | **SLO: 11,12,16,18** |
| Parler du climat - parcours francophone – placer une commande au restaurant –- la mode - parler de son projet d'avenir. | | | |
| **Module 8** | **Contemporary Discussion** | **2 hours** | |
| | | | |
| | **Total Lecture hours:** | **45 hours** | |

| **Text Book(s)** | |
|---|---|
| 1 | Alter Ego 1, Méthode de français, Annie Berthet, Hachette, Paris 2010. |
| 2 | Alter Ego 1, Cahier d'exercices, Annie Berthet, Hachette, Paris 2010. |
| **Reference Books** | |
| 1 | CONNEXIONS 1, Méthode de français, Régine Mérieux, Yves Loiseau,Les Éditions Didier, 2010 |
| 2 | CONNEXIONS 1, Le cahier d'exercices, Régine Mérieux, Yves Loiseau, Les Éditions Didier, 2010 |
| 3 | Fréquence jeunes-1, Méthode de français, G. Capelle et N.Gidon, Hachette, Paris, 2010. |
| 4 | Echo-1, Méthode de français, J. Girardet, J. Pécheur, CLE International, Paris, 2011. |

| **List of Challenging Experiments (Indicative)** | | **SLO:** |
|---|---|---|
| | | |
| 1. | Different types of Verbs for 72 hours | 11,12 |
| 2. | Identifying Nouns and its genders for 72 hours | 11,12 |
| 3. | Listening to the dialogues in Radio and analysing the Tenses | 11,12,16 |
| 4. | Audio files on role model for 20 minutes | 12,16 |
| 5. | Write up on general topics | 18 |
| 6. | Audio files on self-introduction for 20 minutes | 12,16 |
| 7. | Comprehension of a paragraph from online french Newspaper | 11,12,18 |
| 8. | Making students listening to dialogues | 12,16,18 |

| | | | |
|---|---|---|---|
| Recommended by Board of Studies | YES | | |
| Approved by Academic Council | 41st Academic Council | Date | 17.06.2016 |

| Course code | Course title | L | T | P | J | C |
|---|---|---|---|---|---|---|
| STS1001 | Introduction to Soft skills | 3 | 0 | 0 | 0 | 1 |
| Pre-requisite | None | Syllabus version | | | | |
| | | 2 | | | | |

**Course Objectives:**

- Having a clear understanding of professional and ethical responsibility[SLO 10]
- Having adaptive thinking and adaptability[SLO 12]

**Expected Course Outcome:**

- Enabling students to know themselves and interact better with self and environment

**Student Learning Outcomes (SLO):** 10,12

| Module:1 | Lessons on excellence | 10 hours | SLO: 10 |
|---|---|---|---|

**Ethics and integrity**

Importance of ethics in life, Intuitionism vs Consequentialism, Non-consequentialism, Virtue ethics vs situation ethics, Integrity - listen to conscience, Stand up for what is right

**Change management**

Who moved my cheese?, Tolerance of change and uncertainty, Joining the bandwagon, Adapting change for growth - overcoming inhibition

**How to pick up skills faster?**

Knowledge vs skill, Skill introspection, Skill acquisition, "10,000 hours rule" and the converse

**Habit formation**

Know your habits, How habits work? - The scientific approach, How habits work? - The psychological approach, Habits and professional success, "The Habit Loop", Domino effect, Unlearning a bad habit

**Analytic and research skills.**

Focused and targeted information seeking, How to make Google work for you, Data assimilation

| Module:2 | Team skills | 11 hours | SLO: 10 |
|---|---|---|---|

**Goal setting**

SMART goals, Action plans, Obstacles -Failure management

**Motivation**

Rewards and other motivational factors, Maslow's hierarchy of needs, Internal and external motivation

**Facilitation**

Planning and sequencing, Challenge by choice, Full Value Contract (FVC), Experiential learning cycle, Facilitating the Debrief

**Introspection**

Identify your USP, Recognize your strengths and weakness, Nurture strengths, Fixing weakness, Overcoming your complex, Confidence building

**Trust and collaboration**

Virtual Team building, Flexibility, Delegating, Shouldering responsibilities

| Module:3 | Emotional Intelligence | 12 hours | SLO: 12 |
|---|---|---|---|

**Transactional Analysis**

Introduction**,** Contracting, Ego states**,** Life positions

**Brain storming**
Individual Brainstorming, Group Brainstorming, Stepladder Technique, Brain writing, Crawford's Slip writing approach, Reverse brainstorming, Star bursting, Charlette procedure, Round robin brainstorming

**Psychometric Analysis**
Skill Test, Personality Test

**Rebus Puzzles/Problem Solving**
More than one answer, Unique ways

| **Module:4** | **Adaptability** | **12 hours** | **SLO: 12** |
|---|---|---|---|

**Theatrix**
Motion Picture, Drama, Role Play, Different kinds of expressions

**Creative expression**
Writing, Graphic Arts, Music, Art and Dance

**Flexibility of thought**
The 5'P' framework (Profiling, prioritizing, problem analysis, problem solving, planning)

**Adapt to changes(tolerance of change and uncertainty)**
Adaptability Curve , Survivor syndrome

| | **Total Lecture hours:** | **45 hours** | |
|---|---|---|---|

**Text Book(s)**

| | |
|---|---|
| 1. | Chip Heath, How to Change Things When Change Is Hard (Hardcover), 2010, First Edition, Crown Business. |
| 2. | Karen Kindrachuk, Introspection, 2010, 1st Edition. |
| 3. | Karen Hough, The Improvisation Edge: Secrets to Building Trust and Radical Collaboration at Work, 2011, Berrett-Koehler Publishers |

**Reference Books**

| | |
|---|---|
| 1. | Gideon Mellenbergh, A Conceptual Introduction to Psychometrics: Development, Analysis and Application of Psychological and Educational Tests, 2011, Boom Eleven International. |
| 2. | Phil Lapworth, An Introduction to Transactional Analysis, 2011, Sage Publications (CA) |

**Mode of Evaluation**: FAT, Assignments, Projects, Case studies, Role plays,3 Assessments with Term End FAT (Computer Based Test)

| | | | |
|---|---|---|---|
| Recommended by Board of Studies | 09/06/2017 | | |
| Approved by Academic Council | No 45 | Date | 15/06/2017 |

| Course code | | L | T | P | J | C |
|---|---|---|---|---|---|---|
| STS1002 | Introduction to Business Communication | 3 | 0 | 0 | 0 | 1 |
| Pre-requisite | None | Syllabus version | | | | |
| | | 2 | | | | |

**Course Objectives:**

- Having problem solving ability- solving social issues and engineering problems [ SLO 9]
- Having interest in lifelong learning [ SLO 11]

**Expected Course Outcome:**

- Enabling students enhance knowledge of relevant topics and evaluate the information

**Student Learning Outcomes (SLO):** 9, 11

| Module:1 | Study skills | 10 hours | SLO: 9 |
|---|---|---|---|

**Memory techniques**

Relation between memory and brain, Story line technique, Learning by mistake, Image-name association, Sharing knowledge, Visualization

**Concept map**

Mind Map, Algorithm Mapping, Top down and Bottom Up Approach

**Time management skills**

Prioritization - Time Busters, Procrastination, Scheduling, Multitasking, Monitoring

6. Working under pressure and adhering to deadlines

| Module:2 | Emotional Intelligence (Self Esteem ) | 6 hours | SLO: 9 |
|---|---|---|---|

**Empathy**

Affective Empathy and Cognitive Empathy

**Sympathy**

Level of sympathy (Spatial proximity, Social Proximity, Compassion fatigue)

| Module:3 | Business Etiquette | 9 hours | SLO: 9, 11 |
|---|---|---|---|

**Social and Cultural Etiquette**

Value, Manners, Customs, Language, Tradition

**Writing Company Blogs**

Building a blog, Developing brand message, FAQs', Assessing Competition

**Internal Communications**

Open and objective Communication, Two way dialogue, Understanding the audience

**Planning**

Identifying, Gathering Information, Analysis, Determining, Selecting plan, Progress check, Types of planning

**Writing press release and meeting notes**

Write a short, catchy headline, Get to the Point –summarize your subject in the first paragraph, Body – Make it relevant to your audience

| Module:4 | Quantitative Ability | 4 hours | SLO: 9 |
|---|---|---|---|

**Numeracy concepts**

Fractions, Decimals, Bodmas, Simplifications, HCF, LCM, Tests of divisibility

**Beginning to Think without Ink**

Problems solving using techniques such as: Percentage, Proportionality, Support of answer choices, Substitution of convenient values, Bottom-up approach etc.

**Math Magic**

Puzzles and brain teasers involving mathematical concepts

**Speed Calculations**

Square roots, Cube roots, Squaring numbers, Vedic maths techniques

| | | | |
|---|---|---|---|
| **Module:5** | **Reasoning Ability** | **3 hours** | **SLO: 9** |

**Interpreting Diagramming and sequencing information**

Picture analogy, Odd picture, Picture sequence, Picture formation, Mirror image and water image

**Logical Links**

Logic based questions-based on numbers and alphabets

| | | | |
|---|---|---|---|
| **Module:6** | **Verbal Ability** | **3 hours** | **SLO: 11** |

S**trengthening Grammar Fundamentals**

Parts of speech, Tenses, Verbs( Gerunds and infinitives)

**Reinforcements of Grammar concepts**

Subject Verb Agreement, Active and Passive Voice, Reported Speech

| | | | |
|---|---|---|---|
| **Module:7** | **Communication and Attitude** | **10 hours** | **SLO: 11** |

**Writing**

Writing formal & informal letters, How to write a blog & knowing the format, Effective ways of writing a blog, How to write an articles & knowing the format, Effective ways of writing an articles, Designing a brochures

**Speaking skills**

How to present a JAM, Public speaking

**Self managing**

Concepts of self management and self motivation, Greet and Know, Choice of words, Giving feedback, Taking criticism

| | | | |
|---|---|---|---|
| | **Total Lecture hours:** | **45 hours** | |

**Text Book(s)**

| | |
|---|---|
| 1. | FACE, Aptipedia, Aptitude Encyclopedia, 2016, First Edition, Wiley Publications, Delhi. |
| 2. | ETHNUS, Aptimithra, 2013, First Edition, McGraw-Hill Education Pvt. Ltd. |

**Reference Books**

| | |
|---|---|
| 1. | Alan Bond and Nancy Schuman, 300+ Successful Business Letters for All Occasions, 2010, Third Edition, Barron's Educational Series, New York. |
| 2. | Josh Kaufman, The First 20 Hours: How to Learn Anything ... Fast , 2014, First Edition, Penguin Books, USA. |

**Mode of Evaluation**: FAT, Assignments, Projects, Case studies, Role plays,
3 Assessments with Term End FAT (Computer Based Test)

| | | | |
|---|---|---|---|
| Recommended by Board of Studies | 09/06/2017 | | |
| Approved by Academic Council | No 45 | Date | 15/06/2017 |

| Course code | | L | T | P | J | C |
|---|---|---|---|---|---|---|
| STS2001 | Reasoning Skill Enhancement | 3 | 0 | 0 | 0 | 1 |
| Pre-requisite | None | Syllabus version | | | | |
| | | 2 | | | | |

**Course Objectives:**

- Having problem solving ability- solving social issues and engineering problems [SLO 9]
- Having adaptive thinking and adaptability [SLO 12]

**Expected Course Outcome:**

- Understanding the various strategies of conflict resolution among peers and supervisors and respond appropriately

| Student Learning Outcomes (SLO): | 9,12 |
|---|---|

| Module:1 | Social Interaction and Social Media | 6 hours | SLO: 9 |
|---|---|---|---|

**Effective use of social media**

Types of social media, Moderating personal information, Social media for job/profession, Communicating diplomatically

**Networking on social media**

Maximizing network with social media, How to advertise on social media

**Event management**

Event management methods, Effective techniques for better event management

**Influencing**

How to win friends and influence people, Building relationships, Persistence and resilience, Tools for talking when stakes are high

**Conflict resolution**

Definition and strategies , Styles of conflict resolution

| Module:2 | Non Verbal Communication | 6 hours | SLO: 12 |
|---|---|---|---|

**Proxemics**

Types of proxemics**,** Rapport building

**Reports and Data Transcoding**

Types of reports

**Negotiation Skill**

Effective negotiation strategies

**Conflict Resolution**

Types of conflicts

| Module:3 | Interpersonal Skill | 8 hours | SLO:12 |
|---|---|---|---|

**Social Interaction**

Interpersonal Communication, Peer Communication, Bonding, Types of social interaction

**Responsibility**

Types of responsibilities**,** Moral and personal responsibilities

**Networking**

Competition, Collaboration, Content sharing

**Personal Branding**

Image Building, Grooming, Using social media for branding

**Delegation and compliance**

Assignment and responsibility, Grant of authority, Creation of accountability

| **Module:4** | **Quantitative Ability** | **10 hours** | **SLO: 9** |
|---|---|---|---|

**Number properties**

Number of factors, Factorials, Remainder Theorem, Unit digit position, Tens digit position

**Averages**

Averages, Weighted Average

**Progressions**

Arithmetic Progression, Geometric Progression, Harmonic Progression

**Percentages**

Increase & Decrease or successive increase

**Ratios**

Types of ratios and proportions

| **Module:5** | **Reasoning Ability** | **8 hours** | **SLO: 9** |
|---|---|---|---|

**Analytical Reasoning**

Data Arrangement(Linear and circular & Cross Variable Relationship), Blood Relations, Ordering/ranking/grouping, Puzzle test, Selection Decision table

| **Module:6** | **Verbal Ability** | **7 hours** | **SLO: 9** |
|---|---|---|---|

**Vocabulary Building**

Synonyms & Antonyms, One word substitutes, Word Pairs, Spellings, Idioms, Sentence completion, Analogies

| | **Total Lecture hours:** | **45 hours** | |
|---|---|---|---|

**Text Book(s)**


1. FACE, Aptipedia Aptitude Encyclopedia, 2016, First Edition, Wiley Publications, Delhi.
2. ETHNUS, Aptimithra, 2013, First Edition, McGraw-Hill Education Pvt.Ltd.
3. Mark G. Frank, David Matsumoto, Hyi Sung Hwang, Nonverbal Communication: Science and Applications, 2012, 1st Edition, Sage Publications, New York.


**Reference Books**


1. Arun Sharma, Quantitative aptitude, 2016, 7th edition, Mcgraw Hill Education Pvt. Ltd.
2. Kerry Patterson, Joseph Grenny, Ron McMillan, Al Switzler, Crucial Conversations: Tools for Talking When Stakes are High, 2001, 1st edition McGraw Hill Contemporary, Bangalore.
3. Dale Carnegie, How to Win Friends and Influence People, Latest Edition, 2016. Gallery Books, New York.


**Mode of evaluation:** FAT, Assignments, Projects, Case studies, Role plays,
3 Assessments with Term End FAT (Computer Based Test)

| | | | |
|---|---|---|---|
| Recommended by Board of Studies | 09/06/2017 | | |
| Approved by Academic Council | No 45 | Date | 15/06/2017 |

| Course code | | L | T | P | J | C |
|---|---|---|---|---|---|---|
| STS2002 | Introduction to Etiquette | 3 | 0 | 0 | 0 | 1 |
| Pre-requisite | None | Syllabus version | | | | |
| | | 2 | | | | |

**Course Objectives:**

- Having cross cultural competency exhibited by working in teams. [SLO 13]
- Having critical thinking and innovative skills. [SLO 18]

**Expected Course Outcome:**

Creating in the students an understanding of decision making models and generating alternatives using appropriate expressions.

| | |
|---|---|
| **Student Learning Outcomes (SLO):** | **13,18** |

| Module:1 | Impression Management | 8 hours | SLO: 13 |
|---|---|---|---|

**Types and techniques**

Importance of impression management, Types of impression management, Techniques and case studies, Making a good first impression in an interview (TEDOS technique) , How to recover from a bad impressions/experience, Making a good first impression online

**Non-verbal communication and body language**

Dressing, Appearance and Grooming, Facial expression and Gestures, Body language (Kinesics), Keywords to be used, Voice elements (tone, pitch and pace)

| Module:2 | Thinking Skills | 4 hours | SLO:18 |
|---|---|---|---|

**Introduction to problem solving process**

Steps to solve the problem, Simplex process

**Introduction to decision making and decision making process**

Steps involved from identification to implementation**,** Decision making model

| Module:3 | Beyond Structure | 4 hours | SLO:13 |
|---|---|---|---|

**Art of questioning**

How to frame questions, Blooms questioning pyramid, Purpose of questions

**Etiquette**

| | | | |
|---|---|---|---|
| Business, Telephone etiquette, Cafeteria etiquette, Elevator etiquette, Email etiquette, Social media etiquette | | | |
| | | | |
| **Module:4** | **Quantitative Ability** | **9 hours** | **SLO: 18** |
| **Profit and Loss**<br>Cost Price & Selling Price, Margins & Markup<br>**Interest Calculations**<br>Simple Interest, Compound Interest, Recurring<br>**Mixtures and solutions**<br>Ratio & Averages, Proportions<br>**Time and Work**<br>Pipes & Cisterns, Man Day concept, Division Wages<br>**Time Speed and Distance**<br>Average speed, Relative speed, Boats and streams.<br>**Proportions & Variations** | | | |
| | | | |
| **Module:5** | **Reasoning Ability** | **11 hours** | **SLO: 18** |
| **Logical Reasoning**<br>Sequence and series, Coding and decoding, Directions<br>**Visual Reasoning**<br>Abstract Reasoning, Input Type Diagrammatic Reasoning, Spatial reasoning, Cubes<br>**Data Analysis And Interpretation**<br>DI-Tables/Charts/Text | | | |
| | | | |
| **Module:6** | **Verbal Ability** | **9 hours** | **SLO: 13** |
| **Grammar**<br>Spot the Errors, Sentence Correction, Gap Filling Exercise, Sentence Improvisations, Misc. Grammar Exercise | | | |
| | **Total Lecture hours:** | **45 hours** | |

**Text Book(s)**

| | |
|---|---|
| 1. | Micheal Kallet, Think Smarter: Critical Thinking to Improve Problem-Solving and Decision-Making Skills, April 7, 2014, 1st Edition, Wiley, New Jersey. |
| 2. | MK Sehgal, Business Communication, 2008, 1st Edition, Excel Books, India. |
| 3. | FACE, Aptipedia Aptitude Encyclopedia, 2016, First Edition, Wiley Publications, Delhi. |
| 4. | ETHNUS, Aptimithra, 2013, First edition, McGraw-Hill Education Pvt. Ltd, Banglore. |

**Reference Books**

| | |
|---|---|
| 1. | Andrew J. DuBrin, Impression Management in the Workplace: Research, Theory and |

| | |
|---|---|
| | Practice, 2010, 1st edition, Routledge. |
| 2. | Arun Sharma, Manorama Sharma, Quantitative aptitude, 2016, 7th edition, McGraw Hill Education Pvt. Ltd, Banglore. |
| 3. | M. Neil Browne, Stuart M. Keeley, Asking the right questions, 2014, 11th Edition, Pearson, London. |

| | | | |
|---|---|---|---|
| | | | |
| **Mode of Evaluation**: FAT, Assignments, Projects, Case studies, Role plays,<br>3 Assessments with Term End FAT (Computer Based Test) | | | |
| Recommended by Board of Studies | 09/06/2017 | | |
| Approved by Academic Council | No 45 | Date | 15/06/2017 |

| Course code | | L | T | P | J | C |
|---|---|---|---|---|---|---|
| STS3001 | Preparedness for external opportunities | 3 | 0 | 0 | 0 | 1 |
| Pre-requisite | None | Syllabus version | | | | |
| | | 2 | | | | |

**Course Objectives:**

- Having problem solving ability- solving social issues and engineering problems [SLO 9]
- Having critical thinking and innovative skills [SLO 18]

**Expected Course Outcome:**

- Enabling students acquire skills for preparing for interviews, presentations and higher education

**Student Learning Outcomes (SLO):** 9, 18

| Module:1 | Interview Skills | 3 hours | SLO: 9 |
|---|---|---|---|

**Types of interview**

Structured and unstructured interview orientation, Closed questions and hypothetical questions, Interviewers' perspective, Questions to ask/not ask during an interview

**Techniques to face remote interviews**

Video interview, Recorded feedback , Phone interview preparation

**Mock Interview**

Tips to customize preparation for personal interview, Practice rounds

| Module:2 | Resume Skills | 2 hours | SLO: 18 |
|---|---|---|---|

**Resume Template**

Structure of a standard resume**,** Content, color, font

**Use of power verbs**

Introduction to Power verbs and Write up

**Types of resume**

Quiz on types of resume

**Customizing resume**

Frequent mistakes in customizing resume, Layout - Understanding different company's requirement, Digitizing career portfolio

| Module:3 | Presentation Skills | 6 hours | SLO: 18 |
|---|---|---|---|

**Preparing presentation**

10 tips to prepare PowerPoint presentation**,** Outlining the content, Passing the Elevator Test

**Organizing materials**

Blue sky thinking, Introduction , body and conclusion, Use of Font, Use of Color, Strategic presentation

**Maintaining and preparing visual aids**

Importance and types of visual aids, Animation to captivate your audience, Design of posters

**Dealing with questions**

Setting out the ground rules, Dealing with interruptions, Staying in control of the questions, Handling difficult questions

| | | | |
|---|---|---|---|
| **Module:4** | **Quantitative Ability** | **14 hours** | **SLO: 9** |

**Permutation-Combinations**

Counting, Grouping, Linear Arrangement, Circular Arrangements

**Probability**

Conditional Probability, Independent and Dependent Events

**Geometry and Mensuration**

Properties of Polygon, 2D & 3D Figures, Area & Volumes

**Trigonometry**

Heights and distances, Simple trigonometric functions

**Logarithms**

Introduction, Basic rules

**Functions**

Introduction, Basic rules

**Quadratic Equations**

Understanding Quadratic Equations, Rules & probabilities of Quadratic Equations

**Set Theory**

Basic concepts of Venn Diagram

| | | | |
|---|---|---|---|
| **Module:5** | **Reasoning Ability** | **7 hours** | **SLO: 18** |

**Logical reasoning**

Syllogisms, Binary logic, Sequential output tracing, Crypto arithmetic

**Data Analysis and Interpretation**

Data Sufficiency

Data interpretation-Advanced Interpretation tables, pie charts & bar chats

| | | | |
|---|---|---|---|
| **Module:6** | **Verbal Ability** | **8 hours** | **SLO: 18** |

**Comprehension and Logic**

Reading comprehension

Para Jumbles

Critical Reasoning :

Premise and Conclusion, Assumption & Inference, Strengthening & Weakening an Argument

| | | | |
|---|---|---|---|
| **Module:7** | **Writing Skills** | **5 hours** | **SLO: 9** |

**Note making**

What is note making, Different ways of note making

**Report writing**

What is report writing, How to write a report, Writing a report & work sheet

**Product description**

Designing a product, Understanding it's features, Writing a product description

**Research paper**

Research and its importance, Writing sample research paper

| | | | |
|---|---|---|---|
| | **Total Lecture hours:** | **45 hours** | |

**Text Book(s)**

| | | | |
|---|---|---|---|
| 1. | Michael Farra, Quick Resume & Cover letter Book, 2011, 1st Edition, JIST Editors, Saint Paul. | | |
| 2. | Daniel Flage, An Introduction to Critical Thinking, 2002, 1st Edition, Pearson, London. | | |
| **Reference Books** | | | |
| 1. | FACE, Aptipedia Aptitude Encyclopedia, 2016, 1st Edition, Wiley Publications, Delhi. | | |
| 2. | ETHNUS, Aptimithra, 2013, 1st Edition, McGraw-Hill Education Pvt. Ltd. | | |
| **Mode of Evaluation:** FAT, Assignments, Projects, Case studies, Role plays,<br>3 Assessments with Term End FAT (Computer Based Test) | | | |
| Recommended by Board of Studies | 09/06/2017 | | |
| Approved by Academic Council | No 45 | Date | 15/06/2017 |

| Course code | | L | T | P | J | C |
|---|---|---|---|---|---|---|
| STS3004 | Data Structures and Algorithms | 3 | 0 | 0 | 0 | 1 |
| Pre-requisite | None | Syllabus version | | | | |
| | | 2 | | | | |

**Course Objectives:**

- Having Computational thinking (Ability to translate vast data into abstract concepts and to understand database reasoning)[SLO 7]
- Having an ability to use techniques, skills and modern engineering tools necessary for engineering practice [SLO 17]

**Expected Course Outcome:**

- Clear knowledge about problem solving skills in DS & Algorithms concepts

**Student Learning Outcomes (SLO):** 7, 17

| | | | |
|---|---|---|---|
| **Module:1** | **Data Structures** | **10 hours** | **SLO: 7,17** |

Introduction to data structures, Array, Linked List, Stack, Queue, Trees.

| | | | |
|---|---|---|---|
| **Module:2** | **Algorithms** | **15 hours** | **SLO: 7,17** |

Introduction to Algorithms, Searching Algorithms, Sorting Algorithms, Greedy Algorithm, Divide and Conquer, Analysis of Algorithm.

| | | | |
|---|---|---|---|
| **Module:3** | **C Programming** | **10 hours** | **SLO: 7,17** |

Introduction to C, Execution and Structure of a C Program, Data Types and Operators, Control Statements, Looping, Arrays, Structure, Pointers, Memory Management in C, Functions

| | | | |
|---|---|---|---|
| **Module:4** | **C++ Programming** | **5 hours** | **SLO: 7,17** |

Introduction to C++, Need for OOP, Class & Objects, Create C++ & Java class and show the similarity Encapsulation, Access Specifiers, Relationship, Polymorphism, Exception Handling, Abstract Classes.

| | | | |
|---|---|---|---|
| **Module:5** | **JAVA** | **5 hours** | **SLO: 7,17** |

Introduction to Java, Data Types and Operators, Control Statements, Looping, Arrays, Need for OOP, Class & Objects, Create C++ & Java class and show the similarity Encapsulation, Access Specifiers, Relationship, Polymorphism, Exception Handling, Abstract Classes, Interfaces.

| | | | |
|---|---|---|---|
| | **Total Lecture hours:** | **45 hours** | |

**Reference Books**


1. Data Structures and Algorithms: https://ece.uwaterloo.ca/~dwharder/aads/Lecture_materials/
2. C Programming: C Programming Absolute Beginner's Guide (3rd Edition) by Greg Perry, Dean Miller
3. Java: Thinking in Java, 4th Edition


Mode of Evaluation: FAT, Assignments, Projects, 3 Assessments with Term End FAT (Computer Based Test)

| | | | |
|---|---|---|---|
| Recommended by Board of Studies | 09/06/2017 | | |
| Approved by Academic Council | No 45 | Date | 15/06/2017 |

| Course code | Basic Electrical and Electronics Engineering | L | T | P | J | C |
|---|---|---|---|---|---|---|
| EEE1001 | | 2 | 0 | 2 | 0 | 3 |
| Pre-requisite | Nil | Syllabus version | | | | |
| | | 1.00 | | | | |

**Course Objectives:**

This course will provide the student with an overview of the most important concepts in Electrical Engineering

**Expected Course Outcome:**

- Solve simple DC and AC circuits
- Gain knowledge in the underlying principle of electrical and electronics engineering

**Student Learning Outcomes (SLO):** 1,2,5,9,14,17

| Module:1 | DC Circuits | 5 hours | SLO:1,2,9 |
|---|---|---|---|

Basic circuit elements and sources, Ohm's law, Kirchoff's laws, series and parallel connection of circuit elements, Node voltage analysis, Mesh current analysis, Thevenin's and Maximum power transfer theorem

| Module:2 | AC Circuits | 6 hours | SLO:1,2,9 |
|---|---|---|---|

Alternating voltages and currents, AC values, single phase RL, RC, RLC series circuits, Power in AC circuits - Power Factor - Three Phase Systems - Star and Delta Connection - Three Phase Power Measurement - Electrical Safety - Fuses and Earthing, Residential wiring.

| Module:3 | Electrical Machines | 7 hours | SLO: 1,2 |
|---|---|---|---|

Construction, Working Principle and applications of DC Machines, Transformers, Single phase and Three-phase Induction motors, Special Machines - Stepper motor, Servo motor and BLDC motor

| Module:4 | Digital Systems | 5 hours | SLO: 1,2 |
|---|---|---|---|

Basic logic circuit concepts, Representation of Numerical Data in Binary Form - Combinational logic circuits, Synthesis of logic circuits

| Module:5 | Semi conductor devices and circuits | 7 hours | SLO: 1,2 |
|---|---|---|---|

Conduction in semiconductor materials, PN junction diodes, Zener diodes, BJTs, MOSFETs, Rectifiers, Feedback Amplifiers using transistors. **Communication Engineering**: Modulation and demodulation - Amplitude and Frequency Modulation

| | Total Lecture hours: | 30 hours | |
|---|---|---|---|

**Text Book(s)**


1. JohnBird, 'Electrical circuit theory and technology', Newnes publications, 4th Edition, 2010


**Reference Books**


1. AllanR. Hambley, 'Electrical Engineering - Principles & Applications ' Pearson Education, First Impression, 6/e, 2013
2. Simon Haykin, 'Communication Systems', John Wiley & Sons, 5th Edition, 2009
3. Charles K Alexander, Mathew Saiku, 'Fundamendals of Electric Circuits', TATA McGra Hill, 2012
4. Bataresh, 'Poer Electronics Circuits', Wiley, 2003
5. W.H. Hayt, J.E. Kemmerly and S.M. Durbin, 'Engineering Circuit Analysis', 6/e, Tata

| | |
|---|---|
| | McGraw Hill, New Delhi, 2011 |
| 6 | Fitzgerald, Higgabogan, Grabel, 'Basic Electrical Engineering', 5th edition, McGraw Hill, 2009 |
| 7 | S.L.Uppal, 'Electrical Wiring Estimating and Costing, Khanna publishers, New Delhi, 2008 |

| **List of Challenging Experiments (Indicative)** | **SLO: 5,14,17** |
|---|---|
| 1.Thevenin's and Maximum power transfer theorems - Impedance matching of source and load<br>2. Sinusoidal steady state Response of RLC circuits.<br>3. Three phase power measurement for ac loads<br>4. Staircase wiring circuit layout for multi storey building.<br>5. Fabricate and test a PC layout for a rectifier circuit.<br>6. Half and full adder circuits.<br>7. Full wave Rectifier circuits used in DC power suplies. Study the characteristics of the semi conductor devices used.<br>8. Regulated power supply using zener diode. Study the characteristics of the Zener diode used<br>9. Lamp dimmer circuit (Darlington pair circuit using transistors used in cars. Study the characteristics of the transistor used.<br>10. Characteristics of MOSFET | |
| Total Laboratory Hours | 15 hours |

| | | | |
|---|---|---|---|
| Recommended by Board of Studies | 05-06-2015 | | |
| Approved by Academic Council | No. xx | Date | |

| Course code | Digital Logic and Microprocessor | L | T | P | J | C |
|---|---|---|---|---|---|---|
| ITE1001 | | 3 | 0 | 2 | 0 | 4 |
| Pre-requisite | NIL | Syllabus version | | | | |
| | | 1.00 | | | | |

**Course Objectives:**

- To learn logic circuits and converters
- To introduce the components of a digital system
- To understand microprocessor architecture and assembler instruction formats

**Expected Course Outcome:**

- Design, implement and evaluate a computer-based system, process, component, or program to meet desired needs.
- An ability to design a component or a product applying all the relevant standards and with realistic constraints.
- An ability to use techniques, skills and modern Engineering tools.
- An ability to design and conduct experiments, as well as to analyze and interpret data.

**Student Learning Outcomes (SLO): 6,14**

| Module:1 | Introduction | 4 hours | SLO: 14 |
|---|---|---|---|
| Review of number systems - Logic gates: NAND, NOR gate as universal building blocks - Simplification of four-variable Boolean equations using Karnaugh maps | | | |

| Module:2 | Combinational Logic circuits | 5 hours | SLO: 14 |
|---|---|---|---|
| Half adder, Full adder, Half subtractor, Full subtractor - 4-bit parallel adder and subtractor - 3-bit binary decoder – Decimal to BCD encoder – 8-to-1 multiplexer, 1-to-8 Demultiplexer | | | |

| Module:3 | Sequential Logic Circuits | 8 hours | SLO: 14 |
|---|---|---|---|
| Flip-flops: SR flip-flop, Edge-triggered flip-flops (SR,D,JK and T), Master-slave JK flip-flop - 4-bit binary asynchronous and synchronous counter - Decade counter (asynchronous and synchronous) - Shift registers (SISO,SIPO,PISO,PIPO) - Ring counter – Memories (RAM, ROM, EPROM,FLASH) | | | |

| Module:4 | The 8085 Microprocessor Architecture | 4 hours | SLO: 6 |
|---|---|---|---|
| Pin diagram - CPU architecture – Flags-Interrupts – Instruction Set-Addressing mode | | | |

| Module:5 | The 8086 Microprocessor | 8 hours | SLO: 6 |
|---|---|---|---|
| Pin diagram, CPU architecture, addressing mode, Segmentation- Minimum mode maximum mode operations -Memory Interfacing-I/O interfacing | | | |

| Module:6 | Programming model of 8086 | 7 hours | SLO: 6 |
|---|---|---|---|
| Programming model of 8086, Addressing modes, Instruction Formats, Instruction set, Assembler directives and Assembly language Programming of 8086. | | | |

| Module:7 | Peripheral Chips | 7 hours | SLO: 6 |
|---|---|---|---|
| Block diagram – pin diagram**,** 8255 (PPI), 8254 (Timer), 8257 (DMA), 8259 (PIC), 8251 (USART)8279(Keyboard and Display Interfacing) | | | |

| Module:8 | Contemporary issues: | 2 hours | |
|---|---|---|---|

| | | | |
|---|---|---|---|
| | **Total Lecture hours:** | **45 hours** | |

| **Text Book(s)** | |
|---|---|
| 1. | Ramesh Gaonkar, Microprocessor Architecture, Programming, and Applications with the 8085, Sixth Edition, Penram International Publishing, 2013. |
| 2. | Morris Mano, Digital logic and Computer design, 4th Edition, Pearson, 2008. |
| **Reference Books** | |
| 1. | Yu-Cheng Liu, Glenn A. Gibson, Microcomputer Systems: The 8086/8088 Family-Architecture Programming and Design, Second Edition, Pearson, 2015. |
| 2. | R.K. Gaur, Digital Electronics and Microcomputers, Dhanpat Rai Publications, 2012. |

**List of Challenging Experiments (Indicative)** — **SLO: 6,14**

Digital Logic Design

1. Basic Logic Gates
2. Combinational Circuits
3. Adders and Subtractors
4. Code Convertors
5. Parallel Adder and Magnitude Comparator
6. Decoder and Encoder
7. Multiplexer and De-multiplexer
8. Sequential Circuits and Shift registers
9. Counters

Microprocessors

10. To write programs in Assembly Language using 8085 instruction set.
11. To write programs in Assembly Language using 8086 instruction set.
12. To perform interfacing of RAM chip
13. To perform interfacing of keyboard controller
14. To perform interfacing of DMA Controller
15. To perform interfacing of UART/USART

| | |
|---|---|
| 1. | Assume a large room has 3 doors and a switch near each door controls a light in the room. The light is turned on or off by changing the state of any one of the switches.<br>More specifically the following should happen:<br>1. The light is OFF when all 3 switches are open.<br>2. Closing any one switch will turn the light ON.<br>3. Then closing the second switch will have to TURN OFF the light.<br>4. If the light is OFF when the 2 switches are closed, then by closing the third switch the light will TURN ON. |
| 2. | Design hardware that implements the following pseudo-code using the provided Comparator, Adder and Registers, along with as many multiplexers and de-multiplexers as needed. The comparator has two inputs In1 and In2, and three outputs, C1, C2, and C3. If In1 < In2, C1 = 1; if In1 = In2, C2=1; if In1 > In2, C3 =1 (for a given In1 and In2, only one of the comparator outputs can be 1). The Adder takes as inputs two numbers p and q, and produces an output Sum. There are 5 registers for storing the 5 variables, A, B, X, Y, and Z. • Hint: You do not need to use truth table or K-maps. Insert the muxes/demuxes as appropriate, and show the signal connections from the input registers A, B, X to the output registers Y and Z, through the muxes, comparator, adder, and demuxes. Be sure to show the equations for the select lines of the multiplexers/demultiplexers in terms of the comparator outputs, C1, C2, and C3. |

| | |
|---|---|
| | Pseudo-code:<br>If A<B then<br>Z= X+ A<br>Else if A=B then<br>Z= X+ B<br>Else<br>Y = A + B |
| 3. | Design a simplified traffic-light controller that switches traffic lights on a crossing where a north-south (NS) street intersects an east-west (EW) street. The input to the controller is the WALK button pushed by pedestrians who want to cross the street. The outputs are two signals NS and EW that control the traffic lights in the Ns and EW directions. When NS or EW are 0, the red light is on, and when they are 1, the green light is on. When there are no pedestrians, NS=0, EW=1 for a minute, follow by NS=1 and EW=0 for 1 minutes, and so on, when WALK button is pushed, Ns and EW both become 0 for a minute when the present minute expires. After that the NS and EW signals continue alerting. For this traffic-light controller: a) Develop a state diagram. (Hint: can be done using 3 states) b) Draw the state transition table. c) Encode the states using minimum number of bits. d) Derive the logic schematic for a sequential circuit which implements the state transition table. |
| 4. | Many game shows use a circuit to determine which of the contestants ring in first. Design a circuit to determine which of two contestants rings in first. It has two inputs S1 and S0 which are connected to the contestants' buttons. The circuit has two outputs Z1 and Z0 which are connected to LED's to indicate which contestant rang in first. There is also a reset button that is used by the game show host to asynchronously reset the flip-flops to the initial state before each question. If contestant 0 rings in first, the circuit turns on LED 0. Once LED 0 is on, the circuit leaves it on regardless of the inputs until the circuit is asynchronously reset by the game show host. If contestant 1 rings in first, the circuit turns on LED 1 and leaves it on until the circuit is reset. If there is a tie, both LED's are turned on. The circuit requires four states: reset, contestant 0 wins, contestant 1 wins, and tie. One way to map the states is to use state 00 for reset, state 01 for contestant 0 wins, state 10 for contestant 1 wins, and state 11 for a tie. With this mapping, the outputs are equal to the current state, which simplifies the output equations. |
| 5. | Design a simple circuit that could operate a car alarm. The circuit has one input Y which would be connected to the car's door switch to determine if the car door is open or shut. When the door is shut Y = 0, and when the door is open Y = 1. The circuit has one output Z which is used to operate a horn by shorting the wires that go to the horn switch in the steering wheel. When Z = 1, the switch is activated and the horn honks. The circuit would be asynchronously reset by the accessories power line that is high when the ignition is turned on or is in accessory-only mode, both of which require the key to the car. |
| 6. | Design a 12 hour Digital clock which is usually set up to start at 12:00, and they count 12:01, 12:02, 12:03, 12:04, 12:05, 12:06, 12:07, 12:08, 12:09, 12:10, and eventually the clock gets to 12:58, 12:59, 1:00, and so on. The one's place of the minutes (the right-most digit) counts 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, and then repeats. The ten's place of the minutes (second digit from the right) counts 0, 1, 2, 3, 4, 5, and then repeats. The hour counter counts 12, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, and repeats. |
| 7. | Design a Microprocessor based combinational lock which has a combination of five digits. The five digits are entered from a keyboard and they are to be entered within a 10 seconds. If |

| | |
|---|---|
| | the right combination is entered the lock will open. If after 10 seconds either all five digits are not entered or a wrong combination is entered then the display will show an error message. Then the system will allow 5 seconds for the first digit to be entered the second time. If after this time the digit is not entered, the system will turn ON the alarm. If the second try fails, the alarm is also turned ON. Then to reset the system the power has to be turned OFF.(Scrambling Keypad) |
| 8. | Design a microprocessor based Smart Pill Box Alarm System for Elderly people. The system will alert the user 3 times per day for taking up the pills. The user has to set the system into fixed slots: for example: Morning, Afternoon, Evening and Night. The system will deliver a display message such as "Take this Pill X "five minutes before the scheduled time. A real time clock is to be included in the system to display the current time and will show the alarm as per the time slots. |
| 9. | Design an intelligent system for the following real time situation.<br>Consider you are driving a car. You are having a limited display area, where you need to display the fuel status, temperature status, Speed limit, Gear Position based on the priority which suits the following context. "There is an obstacle at a distance of 100m and the same is sensed by a sensor. Based on the sensor input, the display has to be displayed to indicate the function to be performed by the driver." |
| 10. | An event sequence recorder has to be designed for a hospital in your city which will monitor a patient's pulse rate, blood pressure, body temperature. The equipment accepts inputs from different sensors, and prints the sequence in which they operate. It scans the inputs every millisecond and prints in a compact, type of event (normal or abnormal) and time of occurrence. It also communicates these events over an RS232C link to a remote computer. A real-time clock is included. Design the processor unit using 8086. |
| 11. | Elderly users often forget their daily routines. Hence you need to design a microprocessor based unit to help them remember their monthly expenses and bill payments. For example, their house rent, telephone bills, electricity bills, gas requirement, etc. An alarm has to be blown to remind them and when they reset it, it is understood that they have paid and the expense has to be calculated for the entire month and at the end of the month the total expense has to be intimated. |
| 12. | Let say that you work in VIT. Each day there is a rush hour in lunch time - everyone wants to get in the food line first. Your school is at the top floor and only way to get to the lobby is to use a lift. So, you call the lift and wait... and wait. Your waiting time could be infinite because everyone in bottom floors are loading the lift, so it never reaches the top! And when it finally does, your lunch time is over. Design a system to overcome this infinite waiting time. |

| | | | |
|---|---|---|---|
| | | Total Laboratory Hours | 30 hours |
| Recommended by Board of Studies | 04-12-2015 | | |
| Approved by Academic Council | No. 39 | Date | 12-12-2015 |

| Course code | Web Technologies | L | T | P | J | C |
|---|---|---|---|---|---|---|
| ITE1002 | | 2 | 0 | 2 | 0 | 3 |
| Pre-requisite | CSE1001 | Syllabus version | | | | |
| | | 1.10 | | | | |

**Course Objectives:**

- To understand web architecture and web languages
- To program for web client and web server objects
- To understand web development environment and methodology

**Expected Course Outcome:**

- Understand web essentials
- Develop Web Applications
- Implement Client/Server Web programming

**Student Learning Outcomes (SLO):** 6,7

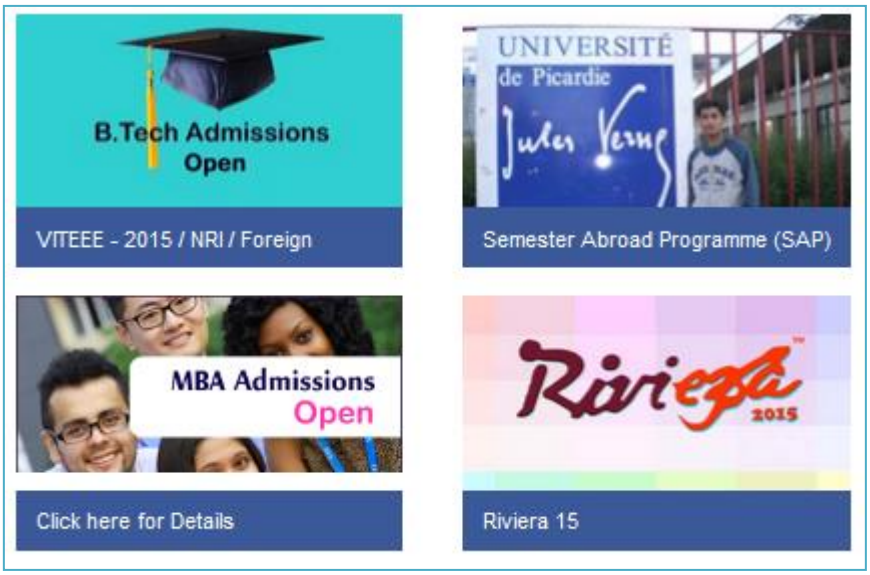
| | | | |
|---|---|---|---|
| **Module:1** | **Web Essentials** | **4 hours** | **SLO: 6** |
| Evolution of Web – Web architecture – HTML –XHTML- CSS | | | |
| **Module:2** | **Client-Side Scripting** | **5 hours** | **SLO: 6** |
| Javascript Basics –Arrays- Functions - Javascript objects – HTML DOM - DOM methods – Events- Regular Expressions – Form Validation-JSON-Jquery | | | |
| **Module:3** | **Web Applications** | **5 hours** | **SLO: 6** |
| Web applications- Web Application Frameworks-MVC framework-Angular JS – Single Page Applications-Responsive Web Design | | | |
| **Module:4** | **Client/Server Communication** | **4 hours** | **SLO: 6** |
| HTTP- Request/Response Model- HTTP Methods- RESTful APIs-AJAX-AJAX with JSON | | | |
| **Module:5** | **Web Servers** | **5 hours** | **SLO: 7** |
| Node.js-NPM- Callbacks -Events- Express framework-Cookies-Sessions-Scaling | | | |
| **Module:6** | **Storage** | **3 hours** | **SLO: 7** |
| MongoDB-Manipulating and Accessing MongoDB Documents from Node js | | | |
| **Module:7** | **Reactive frameworks** | **2 hours** | **SLO: 6** |
| Meteor JS framework – Templates – Events – Sessions – Publish & Subscribe –Accounts | | | |
| **Module:8** | **Contemporary issues:** | **2 hours** | |
| | **Total Lecture hours:** | **30 hours** | |

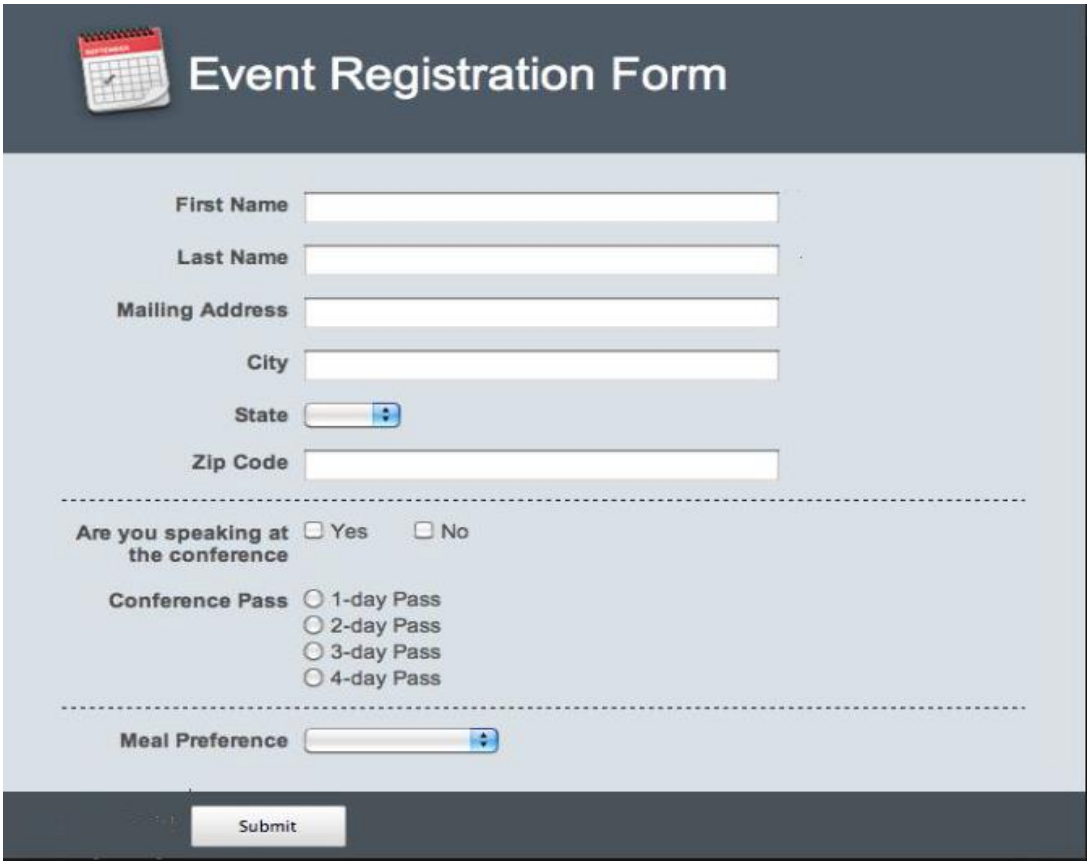
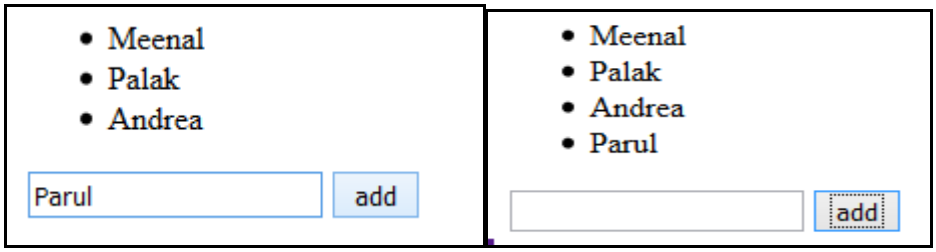
**Text Book(s)**

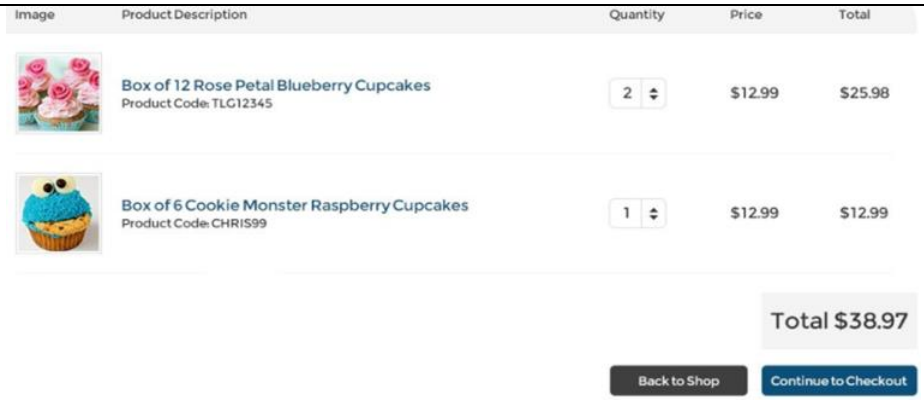
1. Brad Dayley, Node.js, MongoDB, and AngularJS Web Development, Addison Wesley, 2014
2. Morris Mano, Digital logic and Computer design, 4th Edition, Pearson, 2008.

**Reference Books**

1. Jon Duckett,HTML & CSSDesign and Build Websites,Wiley, 2011
2. Jon Duckett,JavaScript and JQuery: Interactive Front-End Web Development,Wiley,2014
3. Holdener, Ajax: The Definitive Guide,Oreilly,2010

| List of Challenging Experiments (Indicative) | SLO: 6,7 |
|---|---|
| 1. | Use DHTML to perform the following.<br>a. Design the spotlight section of VIT home page. Use Box properties of CSS.<br>  <br><br>b. To create a web page which includes a map and display the related information when a hot spot is clicked in the map<br>c. Create a web page which displays an image "ganesha.jpg" and the text "This is image of Lord Ganesh". Place three buttons in the web page which performs the following on clicking them<br>• To right align the image.<br>• To change the height, width and border of the image to 250, 350 and 3 pixels respectively<br>• To change the source and alternate text of the image to "vinayaga.jpg" and "The image cannot be loaded" respectively.<br>16. Design a web page with image gallery and sliding menu for movie reviews |
| 2. | Design the following using JavaScript and DOM<br>a. Given an array of words, write a javascript code to count the number of vowels and number of consonants in each word. Use Regular Expressions.<br>b. Include Image Slide Show Digital clock, Survey Poll to make your webpage Dynamic.<br>Develop a web application to implement online quiz system. The application includes only client side script |
| 3. | Create a popup Login form using jQuery which appears at the center of screen on loading the page after a specified time interval. Include Captcha text in the login page. |
| 4. | a) Validate the Event Registration Form given below using Jquery for the following conditions.<br>• All fields are mandatory |

| | |
|---|---|
| | • Zip code should be exactly five digits<br>• Email validation<br>  <br><br>b). Create a JSON file for a list of cities. Provide autocomplete option for city field using the JSON file as source. |
| 5. | Using Angular JS, add names that are entered in textbox to the list and clear the textbox once the name is added to list.<br>  <br> |
| 6. | Design a shopping cart application using AngularJS. Your shopping webpage should have the provisions for selecting the list of items from different category, Once the items are selected on clicking the submit button the items in the cart with its price should be displayed. Sample design is given below. |

| | |
|---|---|
| |  |
| 7. | Create a MongoDB collection of "books" with the following details: ***Title, ISBN(unique id), Authors, Publication ,Year of Publication and Price.***<br>Write commands for the following:<br>a) Insert a new document with multiple authors.<br>b) Update a document with change in price<br>c) Remove documents with year of publication lesser than 1990. |
| 8. | A MongoDB collection of words has the document structure as:<br>*{*<br>*word:<word>,*<br>*first:<first_letter>,*<br>*last:<last_letter>,*<br>*size: <character_count>*<br>*}*<br>Perform the following operations on those documents using Nodejs.<br>Find the set of words which starts with letters 'a','b' or 'c'.<br>Find the set of words which exactly has 12 letters.<br>Count the number of words that starts and ends with a vowel.<br>Find the first ten words that end with the letter 'e' and display it in descending order. |
| 9. | Develop an Online banking Web application over MEAN stack with the following scenarios.<br>Initially the login page should contain only user id field. On entering the user id, if only the user id exists, password field should be displayed.<br>On successful login, display the account summary with the following details retrieved from the database: Account no, Account type and Available Balance.<br>On the left side top of the page display the Current date, Last Login date and UserName and User Id.<br>The session should expire on logout or if the page is idle for more than 2 minutes. |
| 10. | Create an application in node.js for employee management. The application should manage the following details of an employee: ID, name, surname, cadre and salary. Name and surname are strings, while ID, cadre and Salary are integers.<br>The application should have the following functionalities:<br>To search an employee using his/her ID If the employee exists, it will show his/her data in a form, otherwise an pop message should be displayed stating the employees does not exist.<br>To delete an employee, by specifying his/her ID.<br>To insert a new employee using a form. By default, the form is hidden, by pressing a button the form should appear. If the same button is clicked the form should disappear. Every time the form is shown, it should be empty. The form should allow to specify all data of an employee. If the ID field is left empty, the system will assign the next available ID. If the ID |

| | |
|---|---|
| | is already associated to an employee, the employee data are overwritten. If the ID is not associated to any employee, the employee is created. All the other fields cannot be empty. |
| 11. | . Design an online book store using ExpressJS which has the following features (use the MongoDB database created in Question.No.9):<br>a) Search option based on Title , Author or ISBN<br>b) On retrieving the results , display the book details in table format with the Price field in sorted order using AngularJS |
| 12. | Design a student registration form which takes student name, register number, DOB, program, email id, temporary address, permanent address, phone number. Validate the following using jquery: a. Mobile number should be exactly 10 digits b. Register number should have alphabets and numbers only c. Name should not exceed 30 characters and can be only alphabets. d. Email validation e. Provide a checkbox saying "Permanent address is same as temporary address". If checked, the value of permanent address should be added automatically from temp address. And should be in disabled mode. |

| | | | |
|---|---|---|---|
| | | Total Laboratory Hours | 30 hours |
| Recommended by Board of Studies | 12-08-2017 | | |
| Approved by Academic Council | No. 47 | Date | 05-10-2017 |

| Course code | Database Management Systems | L | T | P | J | C |
|---|---|---|---|---|---|---|
| ITE1003 | | 2 | 0 | 2 | 4 | 4 |
| Pre-requisite | CSE1001 | Syllabus version | | | | |
| | | 1.00 | | | | |

**Course Objectives:**

- To understand the role of data, files and databases in information systems
- To impart knowledge of data modeling techniques
- To provide the fundamentals of front-end and back-end of databases

**Expected Course Outcome:**

- Analyze a system and design ER diagram and Relational Schema.
- Develop a good database application and eliminate the duplicates from an already built database.
- Apply security measures for the database, faster the query execution and make proper transaction in a multiuser environment.

**Student Learning Outcomes (SLO):** 2,5,6

| Module:1 | Fundamental Concepts and Architecture | 3 hours | SLO: 2 |
|---|---|---|---|

Introduction to database system, Characteristics of the Database Approach, Actors on the Scene, Workers behind the Scene, Advantages of using the DBMS Approach, Data Models, Schemas, and Instances, Three-Schema Architecture and Data Independence, The Database System Environment, Centralized and Client/Server Architectures for DBMSs, Classification of Database Management Systems

| Module:2 | Conceptual Database Design | 4 hours | SLO: 5 |
|---|---|---|---|

High-Level Conceptual Data Models for Database Design, Entity Types, Entity Sets, Attributes, and Keys, Relationship Types, Relationship Sets, Roles, and Structural Constraints, Weak Entity Types, ER Diagrams, Naming Conventions, and Design Issues, Relationship Types of Degree Higher than Two, EER diagrams

| Module:3 | Relational Database Design | 5 hours | SLO: 6 |
|---|---|---|---|

Relational Model Constraints, Update Operations, Dealing with Constraint Violations, Relational Algebra, Unary Relational Operations: Operations from Set Theory, Binary Relational Operations, Additional Relational Operations, Database Design Using ER-to-Relational Mapping

| Module:4 | Normalization Theory | 4 hours | SLO: 6 |
|---|---|---|---|

Informal Design Guidelines for Relation Schemas, Functional Dependencies, Inference Rules, Equivalence, and Minimal Cover, Properties of Relational Decompositions, Algorithms for Relational Database Schema Design, Normal Forms Based on Primary Keys, Boyce-Codd Normal Form

| Module:5 | Transaction and Concurrency | 4 hours | SLO: 2 |
|---|---|---|---|

Introduction to Transaction Processing, Desirable Properties of Transactions, Characterizing Schedules Based on Serializability, Concurrency, Two-Phase Locking Techniques for Concurrency Control, Concurrency Control Based on Timestamp Ordering, Multiversion Concurrency Control Techniques

| Module:6 | Recovery and Security | 4 hours | SLO: 2 |
|---|---|---|---|

Recovery Concepts, NO-UNDO/REDO Recovery Based on Deferred Update, Recovery Techniques Based on Immediate Update, Shadow Paging, ARIES Recovery Algorithm, Security issues- Discretionary, Mandatory

| | | | |
|---|---|---|---|
| **Module:7** | **Query Processing and Indexing** | **4 hours** | **SLO: 2** |
| Query Execution plan, Basic algorithms for query execution, Heuristic Query Optimization technique, sparse and dense index, primary, secondary and clustered index, B Tree Vs Hash Index | | | |
| | | | |
| **Module:8** | **Contemporary issues:** | **2 hours** | |
| | | | |
| | | | |
| | **Total Lecture hours:** | **30 hours** | |

| | |
|---|---|
| **Text Book(s)** | |
| 1. | Ramez Elmasri and Shamkant B.Navathe, Fundamentals of Database Systems, Pearson Education,7th edition, 2013 |
| **Reference Books** | |
| 1. | Raghu Rama Krishnan, Database Management Systems, Tata Mcgraw Hill,6th edition,2010. |
| 2. | Abraham Silberschatz, Henry F.Korth and S.Sudarshan, Database System Concepts, Tata Mc Graw Hill, 6th edition, 2011. |
| 3. | Carlos Coronel and Steven Morris, Database System Design and Implementation, cennage learning, 11th edition, 2013. |
| 4. | Bob Bryla and Kevin Loney, Oracle Database 12c The complete Reference, Tata McGraw Hill, 1st edition, 2013. |

**List of Challenging Experiments (Indicative)** — **SLO: 2,5,6**

Railway Reservation System -(Redesigning IRCTC database)

**Train**(train Number, name, source, destination,start_time, reach_time, traveltime, distance, class, days, type)

**Ticket**(PNRNo,Transactionid, from_station, To_station, date_of_journey, class date_of_booking, total_ticket_fare,train number)

**Passenger**(PNR No, Serial no, Name, Age, Reservation_status)

**Train_Route**(Train_No, route_no, station_code, name, arrival_time, depart_time, distance,day)

**Train_Ticket_fare**(Train_No, class, base_fare, reservation_charge, superfast_charge, other_charge, tatkal_charge, service_tax)

| | |
|---|---|
| 1. | Create all the tables specified above. Make underlined columns as primary key.(use number, number(m,n), varchar(n), date, time, timestamp datatypes appropriately)<br>Insert atleast 5 rows to each table. (Check www.irctc.co.in website for actual data)<br>1. Use Interactive insertion for inserting rows to the table.<br>2. Use ADT(varray) for class and days column in Train table. |
| 2. | Write simple DDL/DML Queries to<br>1. Remove all the rows from Passenger table permanently.<br>2. Change the name of the Passenger table to Passenger_Details.<br>3. List all train details.<br>4. List all passenger details.<br>5. Give a list of trains in ascending order of number.<br>6. List the senior citizen passengers details.<br>7. List the station names where code starts with 'M'.<br>8. List the trains details within a range of numbers. |

| | |
|---|---|
| | 9. Change the super fast charge value in train fare as zero , if it is null.<br>10. List the passenger names whose tickets are not confirmed.<br>11. List the base_fare of all AC coaches available in each train.<br>Find the ticket details where transaction id is not known.<br>1. Use Interactive updation for updating the seat no for particular PNR NO.<br>2. Find the train names that are from Chennai to Mumbai, but do not have the source or destination in its name.<br>3. Find the train details that are on Thursday(Use the ADT column created). |
| 3. | Create (Alter table to add constraint) the necessary foreign keys by identifying the relationships in the table.<br>1. Add a suitable constraint to train table to always have train no in the range 10001 to 99999.<br>2. Add a suitable constraint for the column of station name, so that does not take duplicates.<br>3. Change the data type of arrival time, depart time (date -> timestamp or timestamp to date), and do the necessary process for updating the table with new values.<br>4. Add a suitable constraint for the class column that it should take values only as 1A, 2A, 3A, SL, C.<br>5. Add a not null constraint for the column distance in train_route. |
| 4. | Use SQL PLUS functions to.<br>1. Find the passengers whose date of journey is one month from today.<br>2. Print the train names in upper case.<br>3. Print the passenger names with left padding character.<br>4. Print the station codes replacing K with M.<br>5. Translate all the LC in class column (Train_fare) to POT and display.<br>6. Display the fare details of all trains, if any value is ZERO, print as NULL value.<br>7. Display the pnrno and transaction id, if transaction id is null, print 'not generated'.<br>8. Print the date_of_jounrney in the format '27th November 2010'.<br>9. Find the maximum fare (total fare).<br>10. Find the average age of passengers in one ticket.<br>11. Find the maximum length of station name available in the database.<br>12. Print the fare amount of the passengers as rounded value.<br>13. Add the column halt time to train route.<br>14. Update values to it from arrival time and depart time.<br>High Level:<br>15. Update values to arrival time and depart time using conversion functions.<br>16. Display the arrival time, depart time in the format HH:MI (24 hours and minutes). |
| 5. | Write Queries to.<br>Use SET Operators<br>1. Find the train numbers for which reservation have not yet been made.<br>2. Find the train names that donot have a first AC class coach.<br>3. Print all the PNR nos available in the database.<br>4. Find passenger names who have booked to 'Pune'.<br>Use Nested Query(in Operators)<br>1. Find the train names that stop in 'Katpadi'.<br>2. Find the train names that are superfast and the service tax is zero.<br>3. Find the Passenger name who have booked for the train that starts from 'Chennai'.<br>4. Find the trains names that have all the AC coaches and the base fare is less than 3000 for each case.<br>Use Join Query<br>1. Find the train names that stop in 'Katpadi'.<br>2. Find the train names that are superfast and the service tax is zero. |

| | |
|---|---|
| | 3. Find the Passenger name (and train name) who have booked for the train that starts from 'Chennai'.<br>4. Display the trains names, each type of class and the total fare for each type of class.<br>5. Display all the train details and the ticket details(if booked any).<br>6. Create a sequence to provide values for the PNR no.<br>7. Write a query for full outer join using any of the tables above. |
| 6. | Write Queries to.<br>Use Coorelated (and nested) Query<br>1. Find the train names for which ten tickets have been reserved.<br>2. Find the trains that have more than ten substations.<br>3. Find the passengers who do not pass through 'Mettupalam'.<br>4. Find passengers who have booked for super fast trains.<br>Complex queries(use groupby/groupby having/join/nested)<br>1. Take the start station code and end station code and display the train details.<br>2. List the train names and the number of sub stations it has.<br>3. List the stations where all types of trains stop.<br>4. List the trains names that has atleast four bookings.<br>5. Create a table cancellation history( Insert values from ticket and passenger table).<br>6. Create a table for all the train numbers and class available in train_ticket_fare with total seats.<br>7. Find the station name that has highest number of trains stopping at. |
| 7. | 1. Write a simple PL/SQL block to.<br>1. Print the fibonacci series.<br>2. Print the factorial of a given number.<br>3. Print 'NOT confirmed' based on the reservation status, of a particular passenger.<br>4. Print the total seats available for a particular train and for a particular class.<br>2. Write a cursor for the following.<br>1. Retrieve the passenger details for “x” train number and given journey date.<br>2. Display the train name(once) and the substation names.<br>3. Display the fare details of a particular train(use basic exceptions)<br>4.Write a cursor to update the reservation status of the passengers(generate seat number, if seats have reached maximum, put wating list number(30% of total seats), if waiting list number reaches maximum, put PQWL(10%of total seats), RAC-20%) |
| 8. | 1. Write a PL/SQL procedure to.<br>1. List the details of passengers who has reserved next to “Mr. X”.<br>2. PNR No. of a passengers for a given source and a destination.<br>2. Write a PL/SQL function to.<br>1. Get the PNRNo and return the total ticket fare.<br>2. Get the Passenger name , train no and return the total journey time in hours and minutes. |
| 9. | Write a Trigger for the following:<br>1. When a passenger cancels a ticket, do the necessary process and update the cancellation history table.<br>2. When train number is changed, update it in referencing tables.<br>3. When a passenger record is inserted reservation status should be automatically updated. |
| 10. | 1. Use TCL commands for your transactions. (commit,rollback,savepoint)<br>2. Create a role named 'clerk', and give permisson for him to select only the trains starting from 'Katpadi' along with fare details.<br>3. Create a nested table containing trainno,name,source,destination and passengers who have booked for it (PNR no,sno, name,age). Find the passengers whose name start with 'S' and train starts from 'Katpadi' |

| | | | |
|---|---|---|---|
| | | Total Laboratory Hours | 30 hours |
| Recommended by Board of Studies | 0 4-12-2015 | | |
| Approved by Academic Council | No. 39 | Date | 12-12-2015 |

| Course code | Data Structures and Algorithms | L | T | P | J | C |
|---|---|---|---|---|---|---|
| ITE1004 | | 3 | 0 | 2 | 0 | 4 |
| Pre-requisite | NIL | Syllabus version | | | | |
| | | 1.00 | | | | |

**Course Objectives:**

- To study linear and non-linear data structures.
- To master sorting and searching techniques and study their efficiencies.

**Expected Course Outcome:**

- Design an efficient algorithm for a problem using a specified paradigm along with a proper data structure.
- Choose an appropriate design paradigm that solves the given problem efficiently along with appropriate data structures.
- Map real-world problems to algorithmic solutions.
- Analyze algorithms asymptotically and compute the performance analysis of algorithms with the same functionality.
- Identify the existence of problems which defy algorithmic solution.

**Student Learning Outcomes (SLO):** 1,2

| Module:1 | Stack | 6 hours | SLO: 2 |
|---|---|---|---|

Operations on stack, array implementation of stack, applications of stack-balance of parenthesis in algebraic expressions, converting expressions from infix to postfix or prefix form, evaluating postfix or prefix form, Towers of Hanoi problem.

| Module:2 | Queue | 6 hours | SLO: 2 |
|---|---|---|---|

Operations on queue, circular queue, array implementation of queue, applications of queue.

| Module:3 | List | 6 hours | SLO: 2 |
|---|---|---|---|

Singly linked list, doubly linked list, circularly singly linked list, operations on linked lists, Linked representation of stack, Linked representation of Queue.

| Module:4 | Algorithm Analysis | 6 hours | SLO: 1 |
|---|---|---|---|

Asymptotic notations, Abstract data type, growth rate of functions, running time complexity, best, average and worst case analysis – examples.

| Module:5 | Sorting and Searching | 6 hours | SLO: 1 |
|---|---|---|---|

Bubble sort, insertion sort, selection sort, radix sort, merge sort, quick sort, heap sort, Shell sort, linear search, binary search, time complexity analysis of sorting and searching algorithms.

| Module:6 | Hashing | 6 hours | SLO: 2 |
|---|---|---|---|

Hash functions, open hashing-separate chaining, closed hashing - linear probing, quadratic probing, double hashing, random probing, rehashing, extendible hashing.

| Module:7 | Tree and Graph | 6 hours | SLO: 2 |
|---|---|---|---|

Implementation of tree, binary tree traversals, expression tree, binary search tree, AVL tree, Graphs, Graph traversals, and shortest path algorithms-Dijkstra's algorithm.

| Module:8 | Contemporary issues: | 3 hours | |
|---|---|---|---|

| | | | |
|---|---|---|---|
| | **Total Lecture hours:** | **45 hours** | |

| | |
|---|---|
| **Text Book(s)** | |
| 1. | Mark Allen Weiss, "Data structures and algorithm analysis in C", 2nd edition, Pearson education, 2013. |
| **Reference Books** | |
| 1. | Debasis Samanta, "Classic data structures", PHI, 2nd edition, 2014. |
| 2. | Seymour Lipschutz "Data Structures by Schaum Series" 2nd edition, TMH 2013. |
| 3. | Adam Drozdek, "Data structures and algorithms in C++", Cengage learning, 4th edition, 2015. |
| 4. | Michael Goodrich, Roberto Tamassta, Michael H.GoldWasser "Data structures and algorithms in Java" 6th edition. 2014. |

| | | |
|---|---|---|
| **List of Challenging Experiments (Indicative)** | | **SLO: 1,2** |
| 1. | Students of a Programming class arrive to submit assignments. Their register numbers are stored in a LIFO list in the order in which the assignments are submitted. Write a program using array to display the register number of the ten students who submitted first.<br><br>Register number of the ten students who submitted first will be at the bottom of the LIFO list. Hence pop out the required number of elements from the top so as to retrieve and display the first 10 students. | |
| 2. | To facilitate a thorough net surfing, any web browser has back and forward buttons that allow the user to move backward and forward through a series of web pages. To allow the user to move both forward and backward two stacks are employed. When the user presses the back button, the link to the current web page is stored on a separate stack for the forward button. As the user moves backward through a series of previous pages, the link to each page is moved in turn from the back to the forward stack.<br>When the user presses the forward button, the action is the reverse of the back button. Now the item from the forward stack is popped, and becomes the current web page. The previous web page is pushed on the back stack. Simulate the functioning of these buttons using array implementation of<br>Stack. Also provide options for displaying the contents of both the stacks whenever required. | |
| 3. | Design a program to employ a stack for balancing symbols such as parentheses, flower braces and square brackets, in the code snippet given below.<br>for(i=0;i<n;i++)<br>{<br>if(i<5)<br>{ z[i]=x[i]+y[i];<br>p=(((a+b)*c)+(d/(e+f)*g);<br>}<br>Ensure that your program works for any arbitrary expression. | |
| 4. | Most of the bugs in scientific and engineering applications are due to improper usage of precedence order in arithmetic expressions. Thus it is necessary to use an appropriate notation that would evaluate the expression without taking into account the precedence order and parenthesis.<br>a) Write a program to convert the given arithmetic expression into<br>i) Reverse Polish notation<br>ii) Polish notation<br>b) Evaluate the above notations with necessary input. | |
| 5. | Some priests are given three poles and a stack of 4 gold disks, each disk a little smaller than the one beneath it. Their assignment is to transfer all 4 disks from one of the 3 pole to | |

| | |
|---|---|
| | another with 2 important constraints. They can move only one disk at a time, and they can never place a larger disk on top of a smaller one. Design a recursive program for the above Towers of Hanoi puzzle using stack. |
| 6. | In a theme park, the Roller-Coaster ride is started only when a good number of riders line up in the counter (say 20 members). When the ride proceeds with these 20 members, a new set of riders will line up in the counter. This keeps continuing. Implement the above scenario of lining up and processing using arrays with Queue ADT. |
| 7. | When burning a DVD it is essential that the laser beam burning pits onto the surface is constantly fed with data, otherwise the DVD fails. Most leading DVD burn applications make use of a circular buffer to stream data from the hard disk onto the DVD. The first part, the 'writing process' fills up a circular buffer with data, then the 'burning process' begins to read from the buffer as the laser beam burns pits onto the surface of the DVD. If the buffer starts to become empty, the application should continue filling up the emptied space in the buffer with new data from the disk. Implement this scenario using Circular Queue. |
| 8. | a) There is a garage where the access road can accommodate any number of trucks at one time. The garage is built in such a way that only the last truck entered can be moved out. Each of the trucks is identified by a positive integer (a truck_id). Implement dynamically to handle truck moves, allowing for the following commands:<br>i) On_road (truck_id); ii) Enter_garage (truck_ id);<br>iii) Exit_garage (truck_id); iv) Show_trucks (garage or road);<br>If an attempt is made to get a truck out which is not the closest to the garage entry, the error message "Truck x cannot be moved" should be displayed.<br><br>b) For the aforementioned scenario, assume now a circular road and two entries: one for entry, another for exit. Trucks can get out only in the order they got in. Write a program dynamically to handle truck moves allowing for the following commands<br>i) Enter garage (truck name)<br>ii) Exit garage (truck name)<br>iii) Show trucks |
| 9. | Imagine an effective dynamic structure for storing polynomials. Write operations for addition, subtraction, and multiplication of polynomials.<br>I/O description. Input:<br>p1=3x7+5x6+22.5x5+0.35x2<br>p2=0.25x3+0.33x2 -0.01 |
| 10. | Given two sorted lists L1 and L2 write a program to merge the two lists in sorted order after eliminating duplicates. |
| 11. | Write a program to maintain the records of students in an effective dynamic structure. Search a particular record based on the roll number and display the previous and next values of that node with time complexity of O(1). |
| 12. | Assume FLAMES game that tests for relationship has to be implemented using a dynamic structure. The letters in the FLAMES stand for Friends, Love, Affection, Marriage, Enmity and Sister. Initially store the individual letters of the word 'flames' in the nodes of the dynamic structure. Given the count of the number of uncommon letters in the two names 'n', write a program to delete every nth node in it, till it is left with a single node. If the end of the dynamic structure is reached while counting, resume the counting from the beginning. Display the letter that still remains and the corresponding relationship<br>Eg., If Ajay and Jack are the two names, there are 4 uncommon letters in these. So delete 4th node in the first iteration and for the next iteration start counting from the node following the deleted node. |
| 13. | Assume in the Regional Passport Office, a multitude of applicants arrive each day for passport renewal. A list is maintained in the database to store the renewed passports arranged |

| | |
|---|---|
| | in the increased order of passport ID. The list already would contain there cords renewed till the previous day. Apply Insertion sort technique to place the current day's records in the list.<br><br>Later the office personnel wish to sort the records based on the date of renewal so as to know the count of renewals done each day. Taking into consideration the fact that each record has several fields (around 25 fields), follow Selection sort logic to implement the same. |
| 14. | Implement a comparison based sorting algorithm which is not in-place to sort the following strings.<br>best, true, hill, dove, van, good, egg, lap |
| 15. | Write a program to implement Bubble sort, Heap sort and Quick sort techniques to arrange the following sequence of elements in descending order.<br>9, -4, 5, 8,-3, 7, 0, 4, 1, 2.<br>Display the count of number of comparisons and swaps made in each method.<br><br>Apply the same sorting techniques for sorting a large data set [Randomly generate 5000 integers within the range -50000 to 50000 to build the data set]. From your observation and analysis, determine the best sorting technique for working with large numbers. |

| | | | |
|---|---|---|---|
| | | Total Laboratory Hours | 30 hours |
| Recommended by Board of Studies | 0 4-12-2015 | | |
| Approved by Academic Council | No. 39 | Date | 12-12-2015 |

| Course code | Software Engineering-Principles and Practices | L | T | P | J | C |
|---|---|---|---|---|---|---|
| ITE1005 | | 3 | 0 | 0 | 0 | 3 |
| Pre-requisite | CSE1001 | Syllabus version | | | | |
| | | 1.00 | | | | |

**Course Objectives:**

- To understand the concepts of process, product and project development.
- To elucidate the knowledge of requirement analysis.
- To provide the knowledge of software design and testing.
- To introduce the project management techniques.

**Expected Course Outcome:**

- Analyze the software development life cycle.
- Apply software design principles for real time applications.
- Test and implement the software which is developed for multidisciplinary approaches.

**Student Learning Outcomes (SLO):** 2,10,17

| Module:1 | Fundamentals of Software Engineering | 6 hours | SLO: 2 |
|---|---|---|---|

Software Engineering Fundamentals- Software processes: Software life-cycle and process models- Process assessment models- Overview of Project Management activities.

| Module:2 | Requirements Engineering | 7 hours | SLO: 2 |
|---|---|---|---|

Software requirements and specifications- Requirements elicitation- Requirements analysis modeling techniques- Functional and nonfunctional requirements- User requirements, System requirements, requirement validation and software requirement specification document.

| Module:3 | Software Design | 8 hours | SLO: 2 |
|---|---|---|---|

Fundamental design concepts and principles-Design characteristics-System Models-Context, Behavioral, Data and, Object models-Architectural design- System structuring, Control models, Structured design- Object-oriented analysis and design- User interface design

| Module:4 | Software Validation | 6 hours | SLO: 10 |
|---|---|---|---|

Validation planning- Testing fundamentals-Test plan Creation and test case generation- Black-box and white-box testing techniques, Unit testing, Integration, validation, and system testing- Object-oriented testing.

| Module:5 | Software Maintenance and Reengineering | 5 hours | SLO: 10 |
|---|---|---|---|

Software Evolution- Software maintenance, Characteristics of maintainable software- Reengineering

| Module:6 | Software Project management | 5 hours | SLO: 17 |
|---|---|---|---|

Team management, Role identification and assignment, Project tracking, Team problem resolution; Software measurement and estimation techniques.

| Module:7 | CASE tools | 5 hours | SLO: 17 |
|---|---|---|---|

Software quality assurance- Software configuration management Overview of SEICMM, ISO 9000, CMMI, PCMM, TQM and Six Sigma-Overview of CASE tools. Software tools and environments.

| Module:8 | Contemporary issues: | 3 hours | |
|---|---|---|---|

| | | | |
|---|---|---|---|
| | **Total Lecture hours:** | **45 hours** | |

| | |
|---|---|
| **Text Book(s)** | |
| 1. | Ian Sommerville, Software Engineering, Ninth Edition, Pearson, 2013. |
| **Reference Books** | |
| 1. | R. S. Pressman, Software Engineering- A Practitioner's Approach, Eighth Edition, Mc Graw Hill Higher Education, 2014. |

| | | | |
|---|---|---|---|
| | | Total Laboratory Hours | 30 hours |
| Recommended by Board of Studies | 12-08-2017 | | |
| Approved by Academic Council | No. 47 | Date | 05-10-2017 |

| Course code | Theory of Computation | L | T | P | J | C |
|---|---|---|---|---|---|---|
| ITE1006 | | 3 | 0 | 0 | 0 | 3 |
| Pre-requisite | MAT1014 | Syllabus version | | | | |
| | | 1.00 | | | | |

**Course Objectives:**

- To introduce students to the mathematical foundations of computation
- To develop students' ability to understand and conduct mathematical proofs for computation and algorithms.
- To prepare students for more advanced courses in automation theory, formal languages, algorithms & logic

**Expected Course Outcome:**

- Understand the essence of computing through simple computational models.
- Apply these models in practice to solving problems in diverse areas such as pattern matching, cryptography, and language design.
- Think analytically and intuitively for problem-solving situations in related areas of theory in computer science

**Student Learning Outcomes (SLO):** 1, 5

| Module:1 | Mathematical preliminaries | 5 hours | SLO: 1 |
|---|---|---|---|

Sets-Sequences and tuples- functions and relation-graphs-Types of proof-proof by construction, proof by contradiction, proof by induction-Introduction-Strings, Languages, Grammars, Automata.

| Module:2 | Deterministic Finite Automata (DFA) | 5 hours | SLO: 5 |
|---|---|---|---|

Introduction to Finite automata (FA) and examples – Language acceptance and string acceptance by a DFA-Closure properties-Minimization of finite automata-Regular languages- Non regular languages.

| Module:3 | Non- Deterministic Finite Automata(NFA) | 6 hours | SLO: 5 |
|---|---|---|---|

Introduction and examples-Conversion from DFA to NFA Finite Automata with Epsilon transitions- Equivalence of NFA and DFA - FA with output-Moore and mealy machine.

| Module:4 | Regular Expression (RE) | 5 hours | SLO: 5 |
|---|---|---|---|

Recursive definition of regular expression-Regular set-Identities of RE-Equivalence of RE-Identity rules-Inter Conversion RE and FA, Pumping lemma.

| Module:5 | Context-free Grammar (CFG) | 6 hours | SLO: 1 |
|---|---|---|---|

Introduction- Definition, Right-linear grammar-left linear grammar-conversion from right linear grammar to left linear grammar-derivation and ambiguity-Simplification of CFG-Normal forms

| Module:6 | Push down automata (PDA) | 6 hours | SLO: 1 |
|---|---|---|---|

Definition- Construction of pushdown automata- Equivalence of push down automata and context-free grammar.

| Module:7 | Turing machine(TM) | 10 hours | SLO: 1 |
|---|---|---|---|

Definition-Design of Turing machine-Types of Turing machines - Introduction to Context sensitive grammar and languages-Linear bounded automata.

**Undecidabilty:**

Recursively enumerable and recursive languages - Undecidable problems - Halting and PCP problem - Halting problem is undecidable - Chomsky hierarchy of languages.

| | | | |
|---|---|---|---|
| **Module:8** | **Contemporary issues:** | **2 hours** | |
| | | | |
| | | | |
| | **Total Lecture hours:** | **45 hours** | |

| | |
|---|---|
| **Text Book(s)** | |
| 1. | Michael Sipser, Introduction to the Theory of Computation, Third Edition, Wadsworth Publishing Co Inc, 2012. |
| **Reference Books** | |
| 1. | Lewis H.P. & Papadimition C.H., Elements of Theory of Computation, Second Edition, PHI, 2015. |
| 2. | Peter Linz, Introduction to Formal Languages and Automata Theory, PHI, 2011. |

| | | | |
|---|---|---|---|
| Recommended by Board of Studies | 05-03-2016 | | |
| Approved by Academic Council | No. 40 | Date | 18-03-2016 |

| Course code | Computer Architecture and Organization | L | T | P | J | C |
|---|---|---|---|---|---|---|
| ITE2001 | | 3 | 0 | 0 | 0 | 3 |
| Pre-requisite | ITE1001 | Syllabus version | | | | |
| | | 1.00 | | | | |

**Course Objectives:**

- To learn the architecture of computer system.
- To introduce the various design aspects of computer system.
- To familiarize with latest technologies of memory, I/O, ALU design, instruction execution.

**Expected Course Outcome:**

- Design ALU, memory, I/O systems for uniprocessor system and external storage system for computers.
- Analyze the performance of ALU algorithms.
- Develop algorithms to perform efficient mathematical computations like square root calculation.

**Student Learning Outcomes (SLO): 1, 2, 4**

| Module:1 | FUNDAMENTALS OF COMPUTER ARCHITECTURE | 9 hours | SLO: 2 |
|---|---|---|---|

Organization of the von Neumann machine; Instruction formats; Pipeline - fetch/execute cycle, instruction decoding and execution; Registers and register files; Instruction types and addressing modes; Subroutine call and return mechanisms; Other design issues.

| Module:2 | COMPUTER ARITHMETIC | 5 hours | SLO: 1 |
|---|---|---|---|

Data Representation, Hardware and software implementation of arithmetic unit for common arithmetic operations: addition, subtraction, multiplication, division( Fixed point and floating point)-floating point IEEE standards

| Module:3 | DATA REPRESENTATION | 5 hours | SLO: 2 |
|---|---|---|---|

Conversion between integer and real numbers- rounding and truncation; The generation of higher order functions from square roots to transcendental functions; Representation of non-numeric data (character codes, graphical data)

| Module:4 | MEMORY SYSTEM ORGANIZATION AND ARCHITECTURE | 4 hours | SLO: 1 |
|---|---|---|---|

Memory systems hierarchy; Coding, data compression, and data integrity; Electronic, magnetic and optical technologies; Main memory organization, Types of Main memories, and its characteristics and performance; Latency, cycle time, bandwidth, and interleaving; Cache memories (address mapping, line size, replacement and write-back policies)

| Module:5 | VIRTUAL MEMORY | 4 hours | SLO: 1 |
|---|---|---|---|

Virtual memory systems-paging, segmentation, address mapping, page tables, page replacement algorithms; Reliability of memory systems; error detecting and error correcting systems

| Module:6 | INTERFACING AND COMMUNICATION | 8 hours | SLO: 1 |
|---|---|---|---|

I/O fundamentals: handshaking, buffering; I/O techniques: programmed I/O, interrupt-driven I/O, DMA; Buses: bus protocols, local and geographic arbitration. Interrupt structures: vectored and prioritized, interrupt overhead, interrupts and reentrant code

| Module:7 | DEVICE SUBSYSTEMS | 7 hours | SLO: 4 |
|---|---|---|---|

| | | | |
|---|---|---|---|
| External storage systems; organization and structure of disk drives and optical memory; Flash memories, Basic I/O controllers such as a keyboard and a mouse;RAID architectures; I/O Performance; SMART technology and fault detection | | | |
| | | | |
| **Module:8** | **Contemporary issues:** | **3 hours** | |
| | | | |
| | | | |
| | **Total Lecture hours:** | **45 hours** | |
| **Text Book(s)** | | | |
| 1. | J. L. Hennessy & D.A. Patterson, Computer architecture: A quantitative approach, Fifth Edition, Morgan Kaufman, 2012. | | |
| **Reference Books** | | | |
| 1. | W. Stallings, Computer organization and architecture, Seventh Edition, Prentice-Hall, 2013 | | |
| 2. | M. M. Mano, Computer System Architecture, Third Edition, Prentice-Hall 2008. | | |
| 3. | J. P. Hayes, Computer architecture and Organization, Third edition, McGraw Hill, 2012. | | |
| Recommended by Board of Studies | 05-03-2016 | | |
| Approved by Academic Council | No. 40 | Date | 18-03-2016 |

| Course code | Operating Systems | L | T | P | J | C |
|---|---|---|---|---|---|---|
| ITE2002 | | 3 | 0 | 2 | 0 | 4 |
| Pre-requisite | ITE1004 | Syllabus version | | | | |
| | | 1.00 | | | | |

**Course Objectives:**

- To provide an in-depth exposure to the major operating system components.
- To impart knowledge of process, memory and device management.
- To provide an exposure to various security issues related to OS.

**Expected Course Outcome:**

- Understand how the operating system abstractions can be implemented.
- Understand the principles of concurrency and synchronization and apply them to write Concurrent programs/software.
- Develop applications with optimized performance by incorporating key features of operating system such as Hyper-threading.

**Student Learning Outcomes (SLO):** 2,5,17

| Module:1 | Fundamentals | 5 hours | SLO: 2 |
|---|---|---|---|

Computer-System Organization, Computer-System Architecture, Operating-System Structure, Operating-System Operations, Operating-System Services. User and Operating-System Interface, System Calls, Types of System Calls, System Programs.

| Module:2 | Process and Thread Management Basics | 7 hours | SLO: 2 |
|---|---|---|---|

Process Concept, Process Scheduling, Operations on Processes, Inter-process communication, Multicore Programming, Multithreading Models.
Scheduling:
Basic Concepts, Scheduling Criteria, Scheduling Algorithms.

| Module:3 | Mutual Exclusion | 7 hours | SLO: 2 |
|---|---|---|---|

The Critical-Section Problem, Peterson's Solution, Semaphores, Classic Problems of Synchronization.
Deadlock :
Deadlock Characterization , Methods for Handling Deadlocks, Deadlock Prevention ,Deadlock Avoidance , Deadlock Detection.

| Module:4 | Main Memory, virtual and Secondary storage Management | 7 hours | SLO: 5 |
|---|---|---|---|

Swapping, Contiguous Memory Allocation. Segmentation, Paging, Structure of the Page Table Demand Paging, Page Replacement, Allocation of Frames, Thrashing.

| Module:5 | File Systems | 7 hours | SLO: 5 |
|---|---|---|---|

File Concept, Access Methods, File-System Mounting, File-System Structure, File-System Implementation , Directory Implementation, Allocation Methods.

| Module:6 | Disk Management | 4 hours | SLO: 5 |
|---|---|---|---|

Disk Structure, Disk Attachment, Disk Scheduling.

| Module:7 | Windows Operating System | 6 hours | SLO: 17 |
|---|---|---|---|

History, Design Principles, System Components, Terminal Services and Fast User Switching, File System, Networking, Programmer Interface
Mobile operating system –An introduction to Android and its versions, iOS, Windows Phone.

| | | | |
|---|---|---|---|
| **Module:8** | **Contemporary issues:** | **2 hours** | |
| | | | |
| | | | |
| | **Total Lecture hours:** | **45 hours** | |

| | |
|---|---|
| **Text Book(s)** | |
| 1. | A. Silberschatz, P.B. Galvin & G. Gagne, Operating System Concepts, John Wiley, Ninth Edition, 2013. |
| **Reference Books** | |
| 1. | William Stallings, Operating Systems – Internals and Design Principles, Seventh Edition, Prentice Hall, 2011. |

| | | |
|---|---|---|
| **List of Challenging Experiments (Indicative)** | | **SLO: 2,5,17** |
| 1. | **Shell programming**<br>a. Identify the command to print the home directory of each user.<br>b. Develop an interactive grep script that asks for a word and a file name and then finds the number of occurrences of that word in the file.<br>c. Write a shell script that takes a command –line argument and reports on whether it is directory, a file, or something else.<br>d. Write a shell script that determines the period for which a specified user is working on the system.<br>e. Write an interactive file-handling shell program. Let it offer the user the choice of copying, removing, renaming, or linking files. Once the user has made a choice, have the program ask the user for the necessary information, such as the file name, new name and so on.<br>f. Write a shell script that displays a list of all the files in the current directory to which the user has read, write and execute permissions. |
| 2. | **Program to illustrate various methods for process and thread handling**<br>a. Assume that you have given a complex program that contains large number of instructions. The program takes more time to execute if it is executed as a single thread of execution. Analyze the role of the system calls given below and restructure the program using it, so that the execution time of the program can be minimized considerably. Fork(), exec(), getpid(), exit(), wait(), close(), stat(), opendir(), readdir().<br>b. Programs using the I/O system calls of UNIX operating system (open, read, write, etc)<br>c. Program to create processes, child processes and orphan process.<br>d. Program to create a thread to find the factorial of a natural number n.<br><br>e. The Collatz conjecture concerns what happens when we take any positive integer n and apply the following algorithm:<br>n = n/2, if n is even<br>n = 3 × n + 1, if n is odd<br><br>The conjecture states that when this algorithm is continually applied, all positive integers |

| | |
|---|---|
| | will eventually reach 1. For example, if n = 35, the sequence is 35, 106, 53, 160, 80, 40, 20, 10, 5, 16, 8, 4, 2, 1.Write a C program using the fork () system call that generates this sequence in the child process. The starting number will be provided from the command line. For example, if 8 is passed as a parameter on the command line, the child process will output 8, 4, 2, 1. Because the parent and child processes have their own copies of the data, it will be necessary for the child to output the sequence. Have the parent invoke the wait () call to wait for the child process to complete before exiting the program. Perform necessary error checking to ensure that a positive integer is passed on the command line. |
| 3. | a. Assume that two processes named client and server running in the system. It is required that these two processes should communicate with each other using shared memory concept. The server writes alphabets from a..z to the shared memory .the client should read the alphabets from the shared memory and convert it to A…Z. Write a program to demonstrate the above mentioned scenario.<br>b. Design a program using ordinary pipes in which one process sends a string message to a second process, and the second process reverses the case of each character in the message and sends it back to the first process. For example, if the first process sends the message Hi There, the second process will return hI tHERE. This will require using two pipes, one for sending the original message from the first to the second process and the other for sending the modified message from the second to the first process. You can write this program using either UNIX or Windows pipes. |
| 4. | Consider a corporate hospital where we have n number of patients waiting for consultation. The amount of time required to serve a patient may vary, say 10 to 30 minutes. If a patient arrives with an emergency, he /she should be attended immediately before other patients, which may increase the waiting time of other patients. If you are given this problem with the following algorithms how would you devise an effective scheduling so that it optimizes the overall performance such as minimizing the waiting time of all patients. [Single queue or multi-level queue can be used].<br>• Consider the availability of single and multiple doctors<br>• Assign top priority for patients with emergency case, women, children, elders, and<br>youngsters.<br>• Patients coming for review may take less time than others. This can be taken into account<br>while using SJF.<br>a. FCFS<br>b. SJF (primitive and non-pre-emptive ) |
| 5. | Apply the following algorithms for the above case and determine the variations in the resulting parameters.<br>a. Priority<br>b. Round robin. |
| 6. | a. Write a program to calculate the below mentioned parameters and write your inference on implementing future knowledge algorithm [which starts scheduling only after fixed amount of time, even if processes have arrived]. Suppose that the following processes arrive for execution at the times indicated. Each process will run |

| | |
|---|---|
| | for the amount of time listed. [use non pre-emptive scheduling ]<br>Process Arrival Time Burst Time<br>P1 0.0 8<br>P2 0.4 4<br>P3 1.0 1<br><br>b. Calculate the average turnaround time for these processes with the FCFS and SJF scheduling algorithm.<br>c. The SJF algorithm is supposed to improve performance, but notice that we chose to run process P1 at time 0 because we did not know that two shorter processes would arrive soon. Compute what the average turnaround time will be if the CPU is left idle for the first 1 unit and then SJF scheduling is used. Remember that processes P1 and P2 are waiting during this idle time, so their waiting time may increase. [This type of algorithm is called as future knowledge algorithm].<br>d. Consider a system running ten I/O-bound tasks and one CPU-bound task. Assume that the I/O-bound tasks issue an I/O operation once for every millisecond of CPU computing and that each I/O operation takes 10 milliseconds to complete. Also assume that the context-switching overhead is 0.1 Milli second and that all processes are long-running tasks. Write a program to calculate the CPU utilization for a round-robin scheduler when:<br>• The time quantum is 1 millisecond<br>• The time quantum is 10 milliseconds |
| 7. | Many CPU-scheduling algorithms are parameterized. For example, the RR algorithm requires a parameter to indicate the time slice. Multilevel feedback queues require parameters to define the number of queues, the scheduling algorithm for each queue, the criteria used to move processes between queues, and so on.<br>These algorithms are thus really sets of algorithms (for example, the set of RR algorithms for all time slices, and so on). One set of algorithms may include another (for example, the FCFS algorithm is the RR algorithm with an infinite time quantum). What (if any) relation holds between the following pairs of algorithm sets? Implement the below mentioned algorithms for the data given below and determine the efficiency of each algorithm.<br>1. Priority and SJF<br>2. Multilevel feedback queues and FCFS<br>3. Priority and FCFS<br>4. RR and SJF |
| 8. | a. Write a program to find the Fibonacci series using multi-threaded concept.<br>b. Write a multithreaded program that calculates various statistical values for a list of numbers. This program will be passed a series of numbers on the command line and will then create three separate worker threads. One thread will determine the average of the numbers, the second will determine the maximum value, and the third will determine the minimum value. For example, suppose your program is passed the integers<br><br>90 81 78 95 79 72 85 |

| | |
|---|---|
| | The program will report<br>The average value is 82<br>The minimum value is 72<br>The maximum value is 95<br>The variables representing the average, minimum, and maximum values will be stored globally. The worker threads will set these values, and the parent thread will output the values once the workers have exited. |
| 9. | A pair of processes involved in exchanging a sequence of integers. The number of integers that can be produced and consumed at a time is limited to 100. Write a Program to implement the producer and consumer problem using POSIX semaphore for the above scenario. |
| 10. | a. Write a Program to implement the solution for dining philosopher's problem.<br>b. Servers can be designed to limit the number of open connections. For example, a server may wish to have only N socket connections at any point in time. As soon as N connections are made, the server will not accept another incoming connection until an existing connection is released. Write a program to illustrate how semaphores can be used by a server to limit the number of concurrent connections. |
| 11. | a. Write a Program to implement banker's algorithm for Deadlock avoidance<br>b. Consider the following snapshot of a system:<br>Allocation Max<br>A B C D A B C D<br>P0 3 0 1 4 5 1 1 7<br>P1 2 2 1 0 3 2 1 1<br>P2 3 1 2 1 3 3 2 1<br>P3 0 5 1 0 4 6 1 2<br>P4 4 2 1 2 6 3 2 5<br>Using the banker's algorithm, determine whether or not each of the following states is unsafe. If the state is safe, illustrate the order in which the processes may complete. Otherwise, illustrate why the state is unsafe.<br>a. Available = (0, 3, 0, 1)<br>b. Available = (1, 0, 0, 2) |
| 12. | Consider a memory hole of size 1kb initially. When a sequence of memory request arrives as following, illustrate the memory allocation by various approaches and calculate the total amount memory wasted by external fragmentation and internal fragmentation in each approach.<br>a. First fit;<br>b. Best fit<br>c. Worst fit |
| 13. | Write a program to implement the page replacement algorithms.<br>a. FIFO<br>b. LRU<br>c. OPT |
| 14. | Write a program that implements the FIFO, LRU, and optimal pager replacement algorithms. First, generate a random page-reference string where page numbers range from 0 to 9. |

| | | | | |
|---|---|---|---|---|
| | Apply the random page-reference string to each algorithm, and record the number of page faults incurred by each algorithm. Implement the replacement algorithms so that the number of page frames can vary from 1 to 7. Assume that demand paging is used. | | | |
| 15. | Consider a file of size 1 MB. The size of a disk block is 512Bytes. Assume any number of available free blocks in the disk contiguously or non-contiguously. Implement the following algorithms to perform file allocation. Determine the efficiency of each file allocation strategies.<br>a. Sequential<br>b. Indexed<br>c. Linked | | | |
| | | | Total Laboratory Hours | 30 hours |
| Recommended by Board of Studies | 05-03-2016 | | | |
| Approved by Academic Council | No. 40 | Date | 18-03-2016 | |

| Course code | Data Communication and Computer Networks | L | T | P | J | C |
|---|---|---|---|---|---|---|
| ITE3001 | | 3 | 0 | 2 | 0 | 4 |
| Pre-requisite | ITE1004 | Syllabus version | | | | |
| | | 1.00 | | | | |

**Course Objectives:**

- To learn the principles of computer networks with a top-down approach including the Internet protocol stack and the OSI model.
- To introduce the basics of data communication and the functions of layered structure.
- To understand the concepts of Error Control and Flow Control Protocols, various Routing and Congestion Control Algorithms, Network Management and Performance Analysis.

**Expected Course Outcome:**

- Gain extensive knowledge on principles of computer networks and protocols.
- Identify and analyze user requirements so as to utilize them in selecting, implementing, evaluating and administrating computer networks.
- Analyze, design, and implement the computer network concepts.

**Student Learning Outcomes (SLO):** 1,2,5

| | | | |
|---|---|---|---|
| **Module:1** | **Introduction** | **5 hours** | **SLO: 2** |

Uses of Computer Networks – Network Hardware – Network Software – Reference Models – Network Standardization.

| | | | |
|---|---|---|---|
| **Module:2** | **Physical layer** | **5 hours** | **SLO: 2** |

Basis for Data Communication - Guided Transmission Media – Wireless Transmission – Digital Modulation and Multiplexing – PSTN.

| | | | |
|---|---|---|---|
| **Module:3** | **Datalink layer** | **7 hours** | **SLO: 1** |

Design Issues – Error Detection and Correction –Protocols – ARQ - Sliding Window Protocols.

| | | | |
|---|---|---|---|
| **Module:4** | **Mac Sub Layer** | **6 hours** | **SLO: 2** |

Channel Allocation Problems – MAC – Ethernet – Datalink Layer Switching.

| | | | |
|---|---|---|---|
| **Module:5** | **Network layer** | **8 hours** | **SLO: 5** |

Design Issues – Routing Algorithms – Congestion Control Algorithms.

| | | | |
|---|---|---|---|
| **Module:6** | **Internetworking** | **5 hours** | **SLO: 1** |

IPv4- IP address – IPv6 - OSPF-BGP.

| | | | |
|---|---|---|---|
| **Module:7** | **Transport layer** | **7 hours** | **SLO: 5** |

Transport Services – Elements – Congestion Control – QoS - UDP – TCP - Application Layer – DNS – Email – WWW – HTTP.

| | | | |
|---|---|---|---|
| **Module:8** | **Contemporary issues:** | **2 hours** | |
| | **Total Lecture hours:** | **45 hours** | |

**Text Book(s)**

1. Andrew S Tanenbaum and David J. Wetherall, Computer Networks, Fifth Edition, Pearson Publisher, 2010.

| **Reference Books** | |
|---|---|
| 1. | Behrouz A Forouzan, Data communication and Networking, McGraw-Hill, Fifth Edition, New York, 2012. |

| **List of Challenging Experiments (Indicative)** | **SLO: 1,2,5** |
|---|---|
| 1. | There are 20PC's in your network. Five PC's are connected to one Ethernet hub, and five PC's are connected to another hub. Each hub is connected to separate switch and both the switches are connected to a separate router. The routers are connected via an Ethernet bridge. The remaining 10 PC's are connected directly to one of the two switches. How many Ethernet segments are there? Implement this scenario using cisco packet tracer. |
| 2. | Two PC's are located in adjacent rooms and a third PC is in a building 300 yards away. Explain how you could connect the three PC's in a single network. Implement this scenario using cisco packet tracer. |
| 3. | In CRC error correction scheme, choose pattern 1101 and data 100100. Write a code to encode the given data. |
| 4. | There is trouble ticket raised by users of an organization that their files are not getting uploaded in ftp server. Measure the performance between the ftp server and client and diagnose using iperf tool. |
| 5. | A company needs is granted the site address 201.70.64.0. The company needs six subnets. Design the subnets using cisco packet tracer. |
| 6. | In an IPv4 packet the value of header length is 1000 in binary. Write a code to find, how many bytes of options are being carried by this packet? |
| 7. | Write a code to implement border gateway protocol (BGP). |
| 8. | Implement a TCP/IP socket based ATM System. Make the server to maintain the customer details (name, card no, pin and balance). When a client wants to withdraw amount, validate his login with card no & pin, display a welcome message and perform the withdraw operation if he is having sufficient balance or display a warning message. |
| 9. | Write a UDP based server code to get the date of birth of the client and calculate the age as on today. Client has to enter year, month and day of birth. For example, if the date of birth of a user is 1/07/2001 then his age is 14 years 0 months and 17 days if today's date is 18/07/2015. Get today's date from the server. |
| 10. | A reputed organization has two branches in Vellore. In one of the branch office a new manager has been appointed. The Senior Manager from the main office has to send the important records to the branch office. Implement a client server model to accomplish this. |
| 11. | The finance office of VIT wishes to make the transactions more secured. If you are a programmer how you will implement a system to validate the login credentials obtained from the user thereby denying the access to unauthorized users. |
| 12. | Establish a wired network running many applications level services and measure the performance of same. Establish a wireless network running many applications level services and measure the performance of same. Compare the performance of above two scenarios and list out the challenges. |

| | |
|---|---|
| Total Laboratory Hours | 30 hours |

| | | | |
|---|---|---|---|
| Recommended by Board of Studies | 05-03-2016 | | |
| Approved by Academic Council | No. 40 | Date | 18-03-2016 |

| Course code | Network and Information Security | L | T | P | J | C |
|---|---|---|---|---|---|---|
| ITE4001 | | 3 | 0 | 0 | 4 | 4 |
| Pre-requisite | ITE3001 | Syllabus version | | | | |
| | | 1.00 | | | | |

**Course Objectives:**

- To learn principles of cryptography, network and information security.
- To introduce the practices of cryptography and network security technology along with its practical use and applications.

**Expected Course Outcome:**

- Understand the principles of cryptography, network and information security and apply it in suitable security application.
- Apply cryptography and network security technology in practical applications.
- Secure the data transferred over computer networks and devise practical solutions to network security requirements.
- Provide multi-level security for data and databases.

**Student Learning Outcomes (SLO):** 1, 2, 17

| | | | |
|---|---|---|---|
| **Module:1** | **Fundamentals of Security** | **8 hours** | **SLO: 1** |

Definitions & challenges of security, OSI security architecture, attacks & services. Cryptography & cryptanalysis. Classical encryption techniques, substitution techniques, transposition techniques. Block ciphers, DES, AES structure, multiple encryption-triple DES.

| | | | |
|---|---|---|---|
| **Module:2** | **Public Key Crypto Systems, Key Management & Distribution** | **8 hours** | **SLO: 1** |

Number theory fundamentals, principles of pubic key crypto systems, RSA algorithm, Strength of RSA, Diffie-Hellman key exchange, Elliptic curve cryptography. Symmetric key distribution using symmetric and asymmetric encryptions, distribution of public keys, X.509 Certificates, PKI.

| | | | |
|---|---|---|---|
| **Module:3** | **Hash Functions** | **5 hours** | **SLO: 2** |

Cryptographic hash functions, applications, security requirements, hash function based on block chaining, SHA-512

| | | | |
|---|---|---|---|
| **Module:4** | **MAC Codes & Digital Signatures** | **4 hours** | **SLO: 17** |

MAC, security requirements, HMAC, CMAC, key wrapping, Digital signatures.

| | | | |
|---|---|---|---|
| **Module:5** | **User Authentication** | **5 hours** | **SLO: 2** |

Remote user authentication, symmetric and asymmetric encryptions for user authentications, Kerberos, identity management & verification.

| | | | |
|---|---|---|---|
| **Module:6** | **Transport Level Security & E-mail Security** | **6 hours** | **SLO: 17** |

Web security, Secure Socket Layer (SSL), Transport Layer Security (TLS), Secure Shell (SSH), HTTPS, E-mail security, PGP, S/MIME.

| | | | |
|---|---|---|---|
| **Module:7** | **IP & Wireless Security** | **6 hours** | **SLO: 17** |

IP Security, Policy, encapsulating security payload, combining security association, internet key exchange. Wireless security, IEEE 802.11 overview & its security.

| | | | |
|---|---|---|---|
| **Module:8** | **Contemporary issues:** | **3 hours** | |

| | | | |
|---|---|---|---|
| | | | |
| | **Total Lecture hours:** | **45 hours** | |

| | |
|---|---|
| **Text Book(s)** | |
| 1. | William Stallings, Cryptography & Network Security- Principles and Practices, Sixth Edition, Pearson Publishers, 2014. |
| **Reference Books** | |
| 1. | Christof Paar & Jan Pelzl, Understanding cryptography, Heidelberg [u.a.] Springer 2014. |
| 2. | Bragg et al., Network security – The complete reference, Tata Mc Graw Hill, 2012. |

| | | | |
|---|---|---|---|
| Recommended by Board of Studies | 12-08-2017 | | |
| Approved by Academic Council | No. 47 | Date | 05-10-2017 |

| Course Code | Discrete Mathematics and Graph Theory | L | T | P | J | C |
|---|---|---|---|---|---|---|
| MAT-1014 | | 3 | 2 | 0 | 0 | 4 |
| Pre-requisite | None | Syllabus Version | | | | |
| | | v. xx.xx | | | | |

**Course Objectives:**

- To address the challenge of the relevance of lattice theory, coding theory and algebraic structures to computer science and engineering problems.
- To use number theory, in particular congruence theory to cryptography and computer science problems.

**Expected Course Outcome**

At the end of this course, students are expected to

- form truth tables, proving results by truth tables, finding normal forms, proving results by direct and indirect method of proof, understand the concepts of inference theory
- understand the concepts of groups and application of group codes
- use Boolean algebra for minimizing Boolean expressions.
- learn basic concepts of graph theory, shortest path algorithms, concepts of trees

| Student Learning Outcomes (SLO): | 1,2,7 |
|---|---|

| Module:1 | Mathematical Logic and Statement Calculus | 6 hours | SLO: 1,2 |
|---|---|---|---|

Introduction-Statements and Notation-Connectives–Tautologies–Two State Devices and Statement logic -Equivalence - Implications–Normal forms - The Theory of Inference for the Statement Calculus.

| Module:2 | Predicate Calculus | 4 hours | SLO: 1,2 |
|---|---|---|---|

The Predicate Calculus - Inference Theory of the Predicate Calculus.

| Module:3 | Algebraic Structures | 5 hours | SLO: 2,7 |
|---|---|---|---|

Semigroups and Monoids - Groups – Subgroups – Lagranges Theorem Homomorphism – Properties-Group Codes.

| Module:4 | Lattices | 5 hours | SLO: 1,2, |
|---|---|---|---|

Partially Ordered Relations -Lattices as Posets – Hasse Digram – Properties of Lattices.

| | | | |
|---|---|---|---|
| **Module:5** | **Boolean algebra** | **5 hours** | **SLO: 1,**7 |
| Boolean algebra - Boolean Functions-Representation and Minimization of Boolean Functions –Karnaugh map – McCluskey algorithm. | | | |
| | | | |
| **Module:6** | **Fundamentals of Graphs** | **6 hours** | **SLO:** 2,7 |
| Basic Concepts of Graph Theory – Planar and Complete graph - Matrix representation of Graphs – Graph Isomorphism – Connectivity–Cut sets-Euler and Hamilton Paths–Shortest Path algorithms. | | | |
| | | | |
| **Module:7** | **Trees, Fundamental circuits , Cut sets, Graph colouring, covering and Partitioning** | **12 hours** | **SLO:** 2,7 |
| Trees – properties of trees – distance and centers in tree –Spanning trees – Spanning tree algorithms- Tree traversal- Fundamental circuits and cut sets. Bipartite graphs - Chromatic number – Chromatic partitioning – Chromatic polynomial - matching – Covering– Four Color problem. | | | |
| | | | |
| **Module:8** | **Contemporary Issues** | **2 hours** | |
| Industry Expert Lecture | | | |
| | **Total Lecture hours:** | **45 hours** | |
| **Tutorial** | • A minimum of 10 problems to be worked out by students in every Tutorial class.<br>• Another 5 problems per Tutorial Class to be given as home work.<br>**Mode:** Individual Exercises, Team Exercises | **30 hours** | **1,2,7** |

**Text Book(s)**

1. J .P. Trembley and R. Manohar, Discrete Mathematical Structures with Applications to Computer Science, Tata McGraw Hill-35th reprint, 2008.
2. Narasing Deo, Graph theory with application to Engineering and Computer Science

**Reference Books**

1. Kenneth H. Rosen, Discrete Mathematics and its applications, 7th Edition, Tata McGraw Hill, 2012.
2. Kolman, R.C.Busby and S.C.Ross, Discrete Mathematical Structures, 6th Edition, PHI, 2009.
3. Richard Johnsonbaugh, Discrete Mathematics, 8th Edition, Prentice Hall, 2017.
4. S. Lipschutz and M. Lipson, Discrete Mathematics, McGraw Hill Education (India)

| | | | |
|---|---|---|---|
| | Cliffs, NJ, 2007. | | |
| **Mode of Evaluation** | | | |
| Digital Assignments, Quiz, Continuous Assessments, Final Assessment Test | | | |
| Recommended by Board of Studies | XX. XX. 2017 | | |
| Approved by Academic Council | No. | Date | XX.XX.2017 |

| Course Code | Applications of Differential and Difference equations | L | T | P | J | C |
|---|---|---|---|---|---|---|
| MAT-2002 | | 3 | 0 | 2 | 0 | 4 |
| Pre-requisite | MAT1011 | Syllabus Version | | | | |
| | | v. xx.xx | | | | |

**Course Objectives:**

- To provide a comprehensive coverage at an introductory level to the subject of ordinary differential equations and difference equations to solve engineering application oriented problems.
- To understand the nuances of Matrix methods, Laplace transform techniques and eigenvalue problems.

**Expected Course Outcome:**

At the end of this course the students are expected to

- learn and understanding of the Fourier series in Engineering .
- Analyze the problems connected with Matrices, Eigen Values and Vectors, Canonical Forms.
- Identify solutions of differential equations by Laplace transforms in Engineering

| Student Learning Outcomes (SLO): | 1,2,9 |
|---|---|

| Module:1 | Fourier series: | 6 hours | SLO: 1,2 |
|---|---|---|---|

Fourier series - Euler's formulae - Dirichlet's conditions - Change of interval- half range series – RMS

| Module:2 | Matrices: | 6 hours | SLO: 1,9 |
|---|---|---|---|

Eigen values and Eigen vectors - properties of Eigen values and Eigen vectors-Cayley Hamilton theorem -similarity of transformation-orthogonal transformation and nature of quadratic form.

| Module:3 | Solution of Ordinary differential equations : | 6 hours | SLO: 2,9 |
|---|---|---|---|

Linear second order ordinary differential equation with constant coefficients– solutions of homogenous and non-homogenous equations- method of undetermined coefficients –method of variation of parameters- Solutions of Cauchy-Euler and Cauchy Legendre differential equations

| Module:4 | Solution of differential equations through Laplace transform and matrix method: | 8 hours | SLO: 1,9 |
|---|---|---|---|

| | | | |
|---|---|---|---|
| Solution of ODEs - Non homogeneous terms involving Heaviside function - Impulse function - Solving non homogeneous system using Laplace transform. Solving non homogeneous first order system of differential equations $(X' = AX + G, X' = AX)$ - Reduction of nth order differential equation to | | | |
| | | | |
| **Module:5** | **Strum Liouville Problems and Power Series Solutions:** | **6 hours** | **SLO:** 1,9 |
| The Strum-Liouville Problem-orthogonality of Eigen functions - Series solutions of differential equation about ordinary and regular singular points-Legendre differential equations - Bessel's differential equations | | | |
| | | | |
| **Module:6** | **Z-Transform:** | **6 hours** | **SLO:** 2,9 |
| Z-transform-relation between Z-transform and Laplace Transforms – Z-transforms of standard functions - Inverse Z-transforms: by partial fraction method, by convolution method | | | |
| | | | |
| **Module:7** | **Difference Equation:** | **5 hours** | **SLO:** 1,9 |
| Difference equation-first and second order difference equations with constant coefficients-Fibonacci sequence-solution of difference equations-complementary functions - particular integrals by the method of undetermined coefficients - solution of simple difference equations using Z-transforms | | | |
| | | | |
| **Module:8** | **Contemporary Issues** | **2 hours** | |
| Industry Expert Lecture | | | |
| | **Total Lecture hours:** | 45 hours | |

| | |
|---|---|
| **Text Book(s)** | |
| 1. | Advanced Engineering Mathematics by Erwin Kreyszig, 10th Edition, John Wiley India, 2015. |
| **Reference Books** | |
| 1. | Higher Engineering Mathematics by B.S.Grewal, 43rd Edition, Khanna Publishers, India,(2015). |
| 2 | Advanced Engineering Mathematics by Michael D. Greenberg, 2nd Edition, Pearson Education, Indian edition (2006). |

**Mode of Evaluation**

Digital Assignments (Solutions by using soft skills), Continuous Assessment Tests, Quiz, Final

| **List of Challenging Experiments (Indicative)** | | **SLO: 1,2,9** |
|---|---|---|
| 1. | Solving Homogeneous differential equations arising in engineering problems | 2 hours |
| 2. | Solving non-homogeneous differential equations and Cauchy, Legendre equations | 2 hours |
| 3. | Applying the technique of Laplace transform to solve differential equations | 2 hours |
| 4. | Applications of Second order differential equations to Mass spring system | 2 hours |

| | | |
|---|---|---|
| | (damped, undamped, Forced oscillations), LCR circuits etc. | |
| 5. | Visualizing Eigen value and Eigen vectors . | 2 hours |
| 6 | Solving system of differential equations arising in engineering applications | 2 hours |
| 7 | Applying the Power series method to solve differential equations arising in engineering applications | 2 hours |
| 8 | Applying the Frobenius method to solve differential equations arising in engineering applications | 2 hours |
| 9 | Visulizing Bessel and Legendre polynomials | 2 hours |
| 10 | Evaluating Fourier series-Harmonic series | 2 hours |
| 11 | Applying Z-Transforms to functions encountered in engineering | 2 hours |
| 12 | Solving Difference equations arising in engineering applications | 2 hours |
| | Total Laboratory Hours | 24 hours |

| | | | |
|---|---|---|---|
| **Mode of Evaluation:** | | | |
| Weekly Assessment, Final Assessment Test | | | |
| Recommended by Board of Studies | 25-02-2017 | | |
| Approved by Academic Council | No. xx | Date | 16-03-2017 |

| Course Code | Applied Linear Algebra | L | T | P | J | C |
|---|---|---|---|---|---|---|
| MAT-3004 | | 3 | 2 | 0 | 0 | 4 |
| Pre-requisite | MAT2002 | Syllabus Version | | | | |
| | | v. xx.xx | | | | |

**Course Objectives:**

- The objective of this course is to give a presentation of basic concepts of linear algebra to illustrate its power and utility through applications to computer science and Engineering. By the end of the course the students are expected to learn the concepts of vector space, linear transformations, matrices and inner product space. Further the students are expected to solve problems in cryptography, computer graphics and Transform like wavelets

**Expected Course Outcome**

At the end of this course the students are expected to learn

- the abstract concepts (theory) of matrices which is the backbone of modern engineering.
- how to solve the system of linear equations using decomposition methods.
- how to transform the vectors using linear transform which is the basic idea required

| Student Learning Outcomes (SLO): | 1,2,7 |
|---|---|

| Module:1 | System of Linear Equations: | 6 hours | SLO: 1,7 |
|---|---|---|---|

Gaussian elimination and Gauss Jordan methods - Elementary matrices- permutation matrix - inverse matrices - System of linear equations - - LU factorizations.

| Module:2 | Vector Spaces | 6 hours | SLO: 1,2 |
|---|---|---|---|

The Euclidean space $R^n$ and vector space- sub space –linear combination-span-linearly dependent-independent- bases - dimensions-finite dimensional vector space.

| Module:3 | Subspace Properties: | 6 hours | SLO: 2,7 |
|---|---|---|---|

Row and column spaces -Rank and nullity – Bases for subspace – invertibility- Application in interpolation.

| Module:4 | Linear Transformations and applications: | 7hours | SLO: 2, 7 |
|---|---|---|---|

Linear transformations – Basic properties-invertible linear transformation - matrices of linear

| | | | |
|---|---|---|---|
| transformations - vector space of linear transformations – change of bases – similarity | | | |
| | | | |
| **Module:5** | **Inner Product Spaces:** | **6 hours** | **SLO:** 2,7 |
| Dot products and inner products – the lengths and angles of vectors – matrix representations of inner products- Gram-Schmidt orthogonalization | | | |
| | | | |
| **Module:6** | **Applications of Inner Product Spaces**: | **6 hours** | **SLO:** 1,2 |
| QR factorization- Projection - orthogonal projections – relations of fundamental subspaces –Least Square solutions in Computer Codes | | | |
| | | | |
| **Module:7** | **Applications of Linear equations** : | **6hours** | **SLO: 1,7** |
| An Introduction to coding - Classical Cryptosystems –Plain Text, Cipher Text, Encryption, Decryption and Introduction to Wavelets (only approximation of Wavelet from Raw data) | | | |
| | | | |
| **Module:8** | **Contemporary Issues:** | **2 hours** | |
| Industry Expert Lecture | | | |
| | **Total Lecture hours:** | **45 hours** | |
| **Tutorial** | • A minimum of 10 problems to be worked out by students in every Tutorial Class<br>• Another 5 problems per Tutorial Class to be | **30 hours** | **SLO: 1,2,7** |

**Text Book(s)**

1. Jin Ho Kwak and Sungpyo Hong, Linear Algebra, Second edition, Springer(2004). (Topics in the Chapters 1,3,4 &5)
2. Introductory Linear Algebra- An applied first course, 9th Edition Bernard Kolman and

**Reference Books**

1. Stephen Andrilli and David Hecker, Elementary Linear Algebra, 5th Edition, Academic Press(2016)
2. Rudolf Lidl, Guter Pilz 'Applied Abstract Algebra', Second Edition, Springer 2004.
3. Howard Anton and Robert C Busby, Contemporary linear algebra, John Wiley (2003).

**Mode of Evaluation**

Digital Assignments (Solutions by using soft skills), Continuous Assessments, Final Assessment

| | | | |
|---|---|---|---|
| Recommended by Board of Studies | XX. XX. 2017 | | |
| Approved by Academic Council | No. | Date | XX. XX. 2017 |

| Course code | Object Oriented Analysis and Design | L | T | P | J | C |
|---|---|---|---|---|---|---|
| ITE1007 | | 3 | 0 | 0 | 4 | 4 |
| Pre-requisite | CSE1002 | Syllabus version | | | | |
| | | 1.00 | | | | |

**Course Objectives:**

- To learn the basic principles of object orientation and notation
- To familiarize Unified Modeling Language
- To understand Analysis and Design workflow

**Expected Course Outcome:**

- Design a software component or a product applying all the relevant standards
- Use CASE tools.
- Design and conduct experiments, as well as to analyze and interpret data.

**Student Learning Outcomes (SLO):** 2, 5, 6

| | | | |
|---|---|---|---|
| **Module:1** | **Introduction** | **6 hours** | **SLO: 2** |

Structure of Complex Systems, Decomposing Complexity - Elements of Analysis and Design, Object Modeling - Unified Process - Phases of Unified Process.

| | | | |
|---|---|---|---|
| **Module:2** | **Object Oriented Paradigm** | **6 hours** | **SLO: 2** |

Benefits and Risks of Object Oriented Development, Macro and Micro Process Development, Object Interoperability- Designing Interface Objects.

| | | | |
|---|---|---|---|
| **Module:3** | **Methodology and Modeling** | **6 hours** | **SLO: 5** |

Object Oriented Methodologies-Rumbaugh et al.'s object modeling technique-The Booch Methodology-The Jacobson et al. Methodologies, Discussion on few Examples of OOAD Application Scenarios-Choosing a case study for OOAD.

| | | | |
|---|---|---|---|
| **Module:4** | **Object Oriented Analysis** | **6 hours** | **SLO: 2** |

Elements of Analysis – Requirements Workflow – Analysis Workflow

| | | | |
|---|---|---|---|
| **Module:5** | **Object Oriented Design** | **6 hours** | **SLO: 5** |

Elements of Design – O-O Design Workflow – Mapping of Elements onto Phases of Unified Process – UML Diagrams for Design – Iterations – Case Study.

| | | | |
|---|---|---|---|
| **Module:6** | **Design using UML Diagrams –Phase I** | **6 hours** | **SLO: 6** |

Introduction to UML as an Analysis and Design Tool,Class Diagrams, State Transition Diagrams, Object Diagrams, Interaction Diagrams, Use case Diagrams, Activity Diagrams, Collaboration Diagrams and Module Diagrams.

| | | | |
|---|---|---|---|
| **Module:7** | **Design using UML Diagrams –Phase II** | **6 hours** | **SLO: 6** |

Component Diagram, Deployment Diagrams – Mapping of Diagrams to Analysis and Design Components.

| | | | |
|---|---|---|---|
| **Module:8** | **Contemporary issues:** | **3 hours** | |
| | **Total Lecture hours:** | **45 hours** | |

**Text Book(s)**

| | | | | |
|---|---|---|---|---|
| 1. | Grady Booch, Robert A. Maksimchuk , Michael W. Engle, Bobbi J. Young, Jim Conallen , Kelli A. Houston, Object Oriented Analysis and Design with Application ,3rd edition, Addison Wesley, 2012. | | | |
| 2. | Morris Mano, Digital logic and Computer design, 4th Edition, Pearson, 2008. | | | |
| **Reference Books** | | | | |
| 1. | Ali Bahrami, Object Oriented System Development, Tata McGraw-Hill, 2012. | | | |
| 2. | Grady Booch, Ivar Jacobson, James Rumbaugh, The Unified Modelling Language User Guide, Second Edition, Pearson, 2012. | | | |
| Recommended by Board of Studies | | 05-03-2016 | | |
| Approved by Academic Council | | No. 40 | Date | 18-03-2016 |

| Course code | Open Source Programming | L | T | P | J | C |
|---|---|---|---|---|---|---|
| ITE1008 | | 3 | 0 | 0 | 4 | 4 |
| Pre-requisite | CSE1001 | Syllabus version | | | | |
| | | 1.00 | | | | |

**Course Objectives:**

- To understand free and open source technologies.
- To develop web pages using PHP and Perl.
- To learn various tools to develop web pages.

**Expected Course Outcome:**

- Differentiate between open source software and free software.
- Build applications software using Open Source Software.
- Design web domain

| Student Learning Outcomes (SLO): | 2, 5 |
|---|---|

| Module:1 | OSS Fundamentals | 4 hours | SLO: 2 |
|---|---|---|---|
| FOSS- Open Source Philosophy -OSD – Licensing - Open Source vs Closed Source– Open Source vs Free Software – Copyright vs Copyleft. | | | |
| | | | |
| **Module:2** | **Open Source Technologies** | **4 hours** | **SLO: 2** |
| Open Source Servers – browsers – packages. | | | |
| | | | |
| **Module:3** | **Basic PHP** | **7 hours** | **SLO: 5** |
| Installation & Setting Path -Overview - Basics - GUI Programming - Arrays - Functions - Files- Exception Handling. | | | |
| | | | |
| **Module:4** | **Open Source Data Base** | **6 hours** | **SLO: 5** |
| Introduction to MYSQL -Data types - Queries-Interfaces with PHP | | | |
| | | | |
| **Module:5** | **Advanced PHP** | **6 hours** | **SLO: 5** |
| OOPs – File Uploading - Regular Expressions - Sending Mail – Cookies – Session Handling | | | |
| | | | |
| **Module:6** | **Perl** | **8 hours** | **SLO: 5** |
| Introduction – Statements – Arrays – Strings – File Handling. | | | |
| | | | |
| **Module:7** | **Tools for OSS** | **7 hours** | **SLO: 2** |
| Moodle: Installation – Themes – Course & Activity – File Uploading. Ecllipse - IDE PHP: Creating Project – Adding files to Repository – Parsing functionality – Executing the project. Introduction to R-Programming | | | |
| | | | |
| **Module:8** | **Contemporary issues:** | **3 hours** | |
| | | | |
| | | | |
| | **Total Lecture hours:** | **45 hours** | |

**Text Book(s)**

| 1. | Micheal K. Glass, Rommnle Scouarnec, Beginning PHP, Apache, MYSQL |
|---|---|

| | | | |
|---|---|---|---|
| | Web Development, Wiley Dream Tech publishing Inc. New Delhi 2010. | | |
| **Reference Books** | | | |
| 1. | William Rice, Moodle E-learning Course Development, Packt Publishing, Third Edition 2015. | | |
| 2. | Larry Wall, Tom Christiansen & Randal L. Schwartz, Programming Perl, Fourth Edition, O'Reilly, 2012. | | |
| 3. | Gosselin, Diana Kokoska, Robert Easter Brooks, PHP Programming with MySQL, Second Edition, Course Technology, 2010. | | |
| Recommended by Board of Studies | 05-03-2016 | | |
| Approved by Academic Council | No. 40 | Date | 18-03-2016 |

| Course code | Digital Image Processing | L | T | P | J | C |
|---|---|---|---|---|---|---|
| ITE1010 | | 3 | 0 | 0 | 4 | 4 |
| Pre-requisite | MAT3004 | Syllabus version | | | | |
| | | 1.00 | | | | |

**Course Objectives:**

- To introduce the principles of image processing.
- To gain expertise in advanced image processing and analysis systems.
- To emphasize on the areas of restoration, enhancement, segmentation and their applications.

**Expected Course Outcome:**

- Gain expertise in image processing techniques
- Apply their knowledge in real life scenarios like character recognition, automated visual inspection, stereo imaging.

**Student Learning Outcomes (SLO):** 1, 14

| Module:1 | Digital Image Processing Fundamentals | 6 hours | SLO: 1 |
|---|---|---|---|

Introduction, Digital Image Fundamentals, Image acquisition and display using digital devices - Human visual perception, properties –Image Sampling and Quantization-Basic Relationship between Pixels – Color models.

| Module:2 | Image Enhancement in the Spatial Domain | 6 hours | SLO: 1 |
|---|---|---|---|

Introduction- Basic grey level transformation, Histogram Processing, Enhancement using arithmetic/Logic operations – Spatial filtering: smoothing and sharpening.

| Module:3 | Image enhancement in the frequency domain | 6 hours | SLO: 1 |
|---|---|---|---|

Introduction to two-dimensional transforms-Discrete Fourier Transform, Discrete Cosine Transform, Discrete Wavelet Transform-smoothing frequency domain filtering-sharpening frequency domain filtering.

| Module:4 | Image Restoration and Reconstruction | 6 hours | SLO: 1 |
|---|---|---|---|

Noise Models – Restoration in the presence of Noise only- spatial filtering, periodic noise reduction by frequency domain filtering.

| Module:5 | Image Compression | 7 hours | SLO: 14 |
|---|---|---|---|

Lossless Image Compression- The Concept of entropy and Huffman coding; Run-length coding for grey images, Lossy Image Compression – Predictive coding, transform coding – JPEG compression standard, Wavelet-based image compression JPEG2000.

| Module:6 | Image Segmentation | 6 hours | SLO: 14 |
|---|---|---|---|

Detection of discontinuities- Object Detection Methods, Edge Linking and Boundary Detection, Thresholding Methods, Region Oriented Methods.

| Module:7 | Representation and Description | 6 hours | SLO: 14 |
|---|---|---|---|

Chain codes, Polygonal approximation, Signature Boundary Segments, Skeletons. Descriptors: Boundary Descriptors, Regional Descriptors, Relational Descriptors.

| Module:8 | Contemporary issues: | 2 hours | |
|---|---|---|---|

| | | | |
|---|---|---|---|
| | **Total Lecture hours:** | **45 hours** | |

| | |
|---|---|
| **Text Book(s)** | |
| 1. | R. C. Gonzalez, R. E. Woods, Digital Image Processing, Pearson Education, Third Edition, 2013. |
| **Reference Books** | |
| 1. | S. Jayaraman, S. Esakkirazan, T.Veerakumar, Digital Image Processing, First Edition, Tata Mc Graw Hill, 2011 |
| 2. | A. K. Jain, Fundamentals of Digital Image Processing, Pearson Education (Asia) Pvt. Ltd. / Prentice Hall of India, 2015. |
| 3 | John C. Russ, The Image Processing Hand Book, Seventh Edition, CRC Press, 2017 |
| 4 | B. Chanda and D. Dutta Majumdar, Digital Image Processing and Analysis, PHI, 2011 |

| | | | |
|---|---|---|---|
| | | Total Laboratory Hours | 30 hours |
| Recommended by Board of Studies | 05-03-2016 | | |
| Approved by Academic Council | No. 40 | Date | 18-03-2016 |

| Course code | Computer Graphics | L | T | P | J | C |
|---|---|---|---|---|---|---|
| ITE1011 | | 3 | 0 | 0 | 4 | 4 |
| Pre-requisite | MAT 3003 | Syllabus version | | | | |
| | | 1.00 | | | | |

**Course Objectives:**

- To provide a comprehensive introduction to computer graphics.
- To understand basic terminology, progress, issues, and trends in Computer Graphics.
- To study the various applications of computer graphics.

**Expected Course Outcome:**

- Gain proficiency in 2D and 3D computer graphics.
- Understand the interactive computer graphics architecture.
- Enhance their perspective of modern computer system with modeling, analysis and interpretation of2D and 3D visual information.
- Develop computer graphics based applications.

**Student Learning Outcomes (SLO):** 1, 14

| Module:1 | Introduction | 5 hours | SLO: 1 |
|---|---|---|---|

Basic Elements of computer graphics and its Applications, Graphics Rendering Pipeline, Input/output Devices, Raster graphics system, vector graphics system.

| Module:2 | Graphics primitives generation algorithms | 7 hours | SLO: 1 |
|---|---|---|---|

Line drawing algorithms, Circle drawing algorithms, Ellipse drawing algorithms and filling algorithms. Attributes of Output Primitives. Colour models.

| Module:3 | Two dimensional and Three dimensional transformations | 5 hours | SLO: 1 |
|---|---|---|---|

Translation, rotation, scaling, reflection and shearing, Homogenous Coordinates, Composition of Transformations.

| Module:4 | Two dimensional viewing | 6 hours | SLO: 1 |
|---|---|---|---|

2D viewing pipeline, Window to viewport transformation. Three dimensional viewing transformations: 3D viewing pipeline, Projection, Types of projection, Transformation matrix for parallel and perspective projection.

| Module:5 | 2D Clipping algorithms | 7 hours | SLO: 14 |
|---|---|---|---|

Point clipping, line clipping and polygon clipping algorithms. 3D clipping algorithms: point and line clipping algorithms.

| Module:6 | Curves and Modelling | 6 hours | SLO: 1 |
|---|---|---|---|

Parametric Curves: Cubic Splines, Bezier Curves and B-Splines. Solid modelling: Representing solids regularised Boolean set operations, primitive instancing. Object representation techniques: Sweep, Boundary, spatial-partitioning, constructive solid geometry and its comparison.

| Module:7 | Visible surface determination, Illumination and shading | 6 hours | SLO: 14 |
|---|---|---|---|

Visible line determination algorithms: Area-subdivision, BSP tree, octrees and Ray Tracing.

| | | | |
|---|---|---|---|
| Illumination Models: Diffuse, Specular and Ambient Reflection.Polygon Shading: Flat Shading, Gouraud Shading and Phong Shading. | | | |
| | | | |
| **Module:8** | **Contemporary issues:** | **3 hours** | |
| | | | |
| | | | |
| | **Total Lecture hours:** | **45 hours** | |

| | |
|---|---|
| **Text Book(s)** | |
| 1. | James D.Foley, Andries Van Dam, Steven K.Feiner and F.Hughes John, Computer Graphics principles and Practice in C , Second edition, Pearson Publication, 2012. |
| **Reference Books** | |
| 1. | Hearn, Donald D. and Baker, M. Pauline, Computer Graphics using C, Third edition, Prentice Hall Professional Technical Reference, 2010 |
| 2. | Steve Marschner and Peter Shirley, Fundamentals of Computer Graphics, CRC Press, 2015. |
| 3 | Hearn, Donald D. and Baker, M. Pauline, Computer Graphics using OpenGL, Fourth edition, Prentice Hall Professional Technical Reference, 2011. |

| | | | |
|---|---|---|---|
| | | Total Laboratory Hours | 30 hours |
| Recommended by Board of Studies | 05-03-2016 | | |
| Approved by Academic Council | No. 40 | Date | 18-03-2016 |

| Course code | Human Computer Interaction | L | T | P | J | C |
|---|---|---|---|---|---|---|
| ITE1014 | | 3 | 0 | 0 | 4 | 4 |
| Pre-requisite | EEE1001 | Syllabus version | | | | |
| | | 1.00 | | | | |

**Course Objectives:**

- To learn the level of interaction of human with the computers.
- To learn how computers can be used in place of human.
- To understand the techniques and technologies available for gathering the requirements for developing an interactive machine.
- To learn the tools and techniques for design and evaluating the interactive system.

**Expected Course Outcome:**

- To develop an interactive machine based on the level of human interference required.
- To gather requirements for the model of human interaction with computer.
- To evaluate the designed interactive system as per the participatory design and work environment.

**Student Learning Outcomes (SLO):** 2,6

| Module:1 | Humans in HCI: | 6 hours | SLO: 2 |
|---|---|---|---|

Perceptual-Motor Interaction: Some Implications for Human–Computer Interaction, Human Information Processing: An Overview for Human–Computer Interaction, Mental Models in Human–Computer Interaction, Task Loading and Stress in Human–Computer Interaction, Choices and Decisions of Computer Users.

| Module:2 | Computers in HCI: | 6 hours | SLO: 2 |
|---|---|---|---|

Input Technologies and Techniques, Sensor- and Recognition-Based Input for Interaction, Visual Displays, Haptic Interface, Non-speech Auditory and Cross modal Output, Network-Based Interaction, Wearable Computers, Design of Fixed, Portable, and Mobile Information Devices

| Module:3 | Requirements Specification: | 7 hours | SLO: 6 |
|---|---|---|---|

User Experience Requirements Analysis within the Usability Engineering Lifecycle, Task Analysis, Contextual Design, Grounded Theory Method in Human–Computer Interaction and Computer-Supported Cooperative Work, An Ethnographic Approach to Design

| Module:4 | Design and Development: | 7 hours | SLO: 6 |
|---|---|---|---|

Putting Personas to Work, Prototyping Tools and Techniques, Scenario-Based Design, Participatory Design

| Module:5 | Testing, Evaluation, and Technology Transfer: | 6 hours | SLO: 6 |
|---|---|---|---|

Usability Testing, Usability for Engaged Users, Survey Design and Implementation in HCI, Inspection-Based Evaluations, Model-Based Evaluation

| Module:6 | Application-/Domain-Specific Design: | 5 hours | SLO: 6 |
|---|---|---|---|

Human–Computer Interaction in Health Care, Motor Vehicle–Driver Interfaces, Human–Computer Interaction in Aerospace, Human–Computer Interaction for Kids

| Module:7 | Emerging Phenomena in HCI: | 6 hours | SLO: 6 |
|---|---|---|---|

Augmenting Cognition in HCI, Social Networks and Social Media, Changing Human–Computer Interaction to Change the World, Ubiquitous Computing.

| | | | |
|---|---|---|---|
| **Module:8** | **Industry Expert Lecture** | **2 hours** | |
| | | | |
| | | | |
| | **Total Lecture hours:** | **45 hours** | |

| | |
|---|---|
| **Text Book(s)** | |
| 1. | Dr. Julie A Jacko, Human Computer Interaction Handbook: Fundamentals, Evolving Technologies, and Emerging Applications, Third Edition, CRC Press, Taylor and Francis Group, 2012. |
| **Reference Books** | |
| 1. | Sharp, Rogers, Preece, Interaction Design-Beyond Human Computer Interaction, Fourth Edition, Wiley, 2015. |
| 2. | Don Norman, The Design of Everyday Things, Revised and Expanded Edition, Basic Books, Perseus Books Group, 2013. |

| | | | |
|---|---|---|---|
| Recommended by Board of Studies | 05-03-2016 | | |
| Approved by Academic Council | No. 40 | Date | 18-03-2016 |

| Course code | Soft Computing | L | T | P | J | C |
|---|---|---|---|---|---|---|
| ITE1015 | | 3 | 0 | 0 | 4 | 4 |
| Pre-requisite | MAT2001 | Syllabus version | | | | |
| | | 1.00 | | | | |

**Course Objectives:**

- To introduce fundamental concepts of soft computing techniques.
- To explain various architectures & algorithms of neural networks.
- To learn fuzzy sets, fuzzy logic, rough sets and genetic algorithms.

**Expected Course Outcome:**

- To analyze the given computational task for its appropriateness of applying soft computing techniques.
- To apply soft computing techniques for practical applications.
- To design a soft computing system required to address a computational task.

**Student Learning Outcomes (SLO):** 1, 2, 7

| | | | |
|---|---|---|---|
| **Module:1** | **Neural networks:** | **7 hours** | **SLO: 2** |

Introduction to Soft computing, basics. Neural networks, introduction, evolution, basic models, terminologies of ANN, Pitts model, Perceptron, Adaline, Back-propagation network, RBF network.

| | | | |
|---|---|---|---|
| **Module:2** | **Memory Models:** | **5 hours** | **SLO: 7** |

Pattern association, auto & hetero associative memory models, BAM, Hopfiled network.

| | | | |
|---|---|---|---|
| **Module:3** | **Unsupervised Networks:** | **6 hours** | **SLO: 7** |

Self-organizing maps, LVQ network, ART network.

| | | | |
|---|---|---|---|
| **Module:4** | **Fuzzy sets:** | **6 hours** | **SLO: 1** |

Introduction, fuzzy sets, operations, fuzzy relations, membership functions, fuzzification & defuzzification.

| | | | |
|---|---|---|---|
| **Module:5** | **Fuzzy logic and approximate reasoning:** | **7 hours** | **SLO: 2** |

Fuzzy truth values, fuzzy propositions, fuzzy rules, formation, decomposition and aggregation of rules, fuzzy reasoning, FIS, Fuzzy Decision Making.

| | | | |
|---|---|---|---|
| **Module:6** | **Rough Sets:** | **5 hours** | **SLO: 7** |

Information & decision systems, indiscernability, set approximations, properties of rough sets, rough memberships, reducts, and approximations.

| | | | |
|---|---|---|---|
| **Module:7** | **Search Strategies:** | **6 hours** | **SLO: 2** |

Genetic algorithms, hybrid systems.

| | | | |
|---|---|---|---|
| **Module:8** | **Contemporary issues:** | **3 hours** | |
| | **Total Lecture hours:** | **45 hours** | |

**Text Book(s)**

1. Sivanandam, Deepa, Principles of Soft Computing, Second Edition, Wiley India, 2011.

**Reference Books**

1. Samir Roy and Udit Chakraborty, Introduction to Soft Computing, Pearson Education, 2013.

| | | | | |
|---|---|---|---|---|
| 2. | T.J. Ross, Fuzzy logic with Engineering Applications, Third Edition, Wiley India, 2010. | | | |
| 3. | Laurene Fausett, Fundamentals of Neural networks: architectures, algorithms and applications, Pearson India, 2008. | | | |
| Recommended by Board of Studies | | 05-03-2016 | | |
| Approved by Academic Council | | No. 40 | Date | 18-03-2016 |

| Course code | Mobile Application Development | L | T | P | J | C |
|---|---|---|---|---|---|---|
| ITE1016 | | 3 | 0 | 0 | 4 | 4 |
| Pre-requisite | CSE1001 | Syllabus version | | | | |
| | | 1.00 | | | | |

**Course Objectives:**

- To be exposed to technology and business trends impacting mobile applications.
- To understand mobile design principles.
- To learn working knowledge of Apple's Xcode app development tool.

**Expected Course Outcome:**

- Evaluate and contrast requirements for mobile platforms to establish appropriate strategies for development and deployment.
- Produce apps for Android and iOS platform devices.
- Interpret a scenario to plan, design and develop a prototype hybrid and native mobile application using an appropriate software development environment.

**Student Learning Outcomes (SLO): 5, 6, 12**

| | | | |
|---|---|---|---|
| **Module:1** | **Introduction to Mobile Application:** | **6 hours** | **SLO: 5** |
| A brief history of mobile-Mobile ecosystem, Designing for context, Developing a Mobile Strategy, Mobile Information Architecture, Mobile Design, Types of mobile application. | | | |
| **Module:2** | **Technologies**: | **6 hours** | **SLO: 5** |
| Introduction-HTML5,CSS3, Javascript, JQuery. | | | |
| **Module:3** | **Introduction to Android programming:** | **5 hours** | **SLO: 12** |
| Android toolkit, Java for android, components of an Android Application. | | | |
| **Module:4** | **Android software development:** | **7 hours** | **SLO: 12** |
| Eclipse Concepts and Terminology, Eclipse Views and Perspectives, Eclipse and Android, Effective java for Android | | | |
| **Module:5** | **Android Framework:** | **6 hours** | **SLO: 12** |
| Building a View, Fragments and Multiplatform Support, Drawing, Handling and Persisting Data. | | | |
| **Module:6** | **Introduction to iOS:** | **6 hours** | **SLO: 6** |
| Basic iPhone Styling, Advanced iPhone Styling, Animation | | | |
| **Module:7** | **Iphone data storage:** | **6 hours** | **SLO: 6** |
| local Storage and session Storage, Client-Side Database PhoneGap tool. | | | |
| **Module:8** | **Contemporary issues:** | **3 hours** | |
| | | | |
| | | | |
| | **Total Lecture hours:** | **45 hours** | |

| | | | |
|---|---|---|---|
| **Text Book(s)** | | | |
| 1. | App Programming Guide for iOS-Apple developer - 2014 Apple Inc | | |
| **Reference Books** | | | |
| 1. | Jonathan Stark, Building iPhone Apps with HTML, CSS and JavaScript, O'Reilly Media, 2011. | | |
| 2. | Paul Deitel,Harvey Deitel,Android for programmers an app-driven approach Deiteldeveloper series,<br>Abbey Deitel,Michael Morgano-2012 Pearson Education, Inc. | | |
| 3. | Laird Dornin, G. Blake Meike, and Masumi Nakamura, Programming Android by Zigurd Mednieks, O'Reilly Media, 2011. | | |
| Recommended by Board of Studies | | 05-03-2016 | |
| Approved by Academic Council | | No. 40 | Date 18-03-2016 |

| Course code | Transformation Techniques | L | T | P | J | C |
|---|---|---|---|---|---|---|
| ITE1017 | | 3 | 0 | 0 | 0 | 3 |

| Pre-requisite | MAT2002 | Syllabus version |
|---|---|---|
| | | 1.00 |

**Course Objectives:**

- To introduce various mathematical transform techniques that can be used in diverse areas of engineering domains.

**Expected Course Outcome:**

- Learn Relevant Transform techniques to solve real time problems.
- Understand Z transforms for Signal processing applications (speech processing)
- Apply Orthogonal and non-orthogonal techniques to Image processing Applications (medical)
- Learn Statistical based and Directional transforms to automotive applications
- Apply Wavelet and other advanced transforms to video processing applications (surveillance)

**Student Learning Outcomes (SLO):** 1, 2, 9

| Module:1 | 2D signals and Systems: | 6 hours | SLO: 2 |
|---|---|---|---|

Separable Sequence - Periodic sequence - Classification of 2D Systems - 2D Convolution - 2D Z-Transform - Properties - 2D Inverse Z transform - 2D Digital Filter

| Module:2 | Convolution and Correlation: | 7 hours | SLO: 1 |
|---|---|---|---|

2D Convolution through Graphical Method - Convolution through Z-Transform - 2D Convolution through Matrix Analysis - Circular Convolution – Applications

| Module:3 | Sinusoidal, Orthogonal transforms: | 7 hours | SLO: 9 |
|---|---|---|---|

Orthogonal sinusoidal basis function - Fourier transform - Fast FFT - Properties - Discrete Cosine transform - Discrete sine transform – Applications

| Module:4 | Non-sinusoidal Orthogonal Transforms: | 6 hours | SLO: 2 |
|---|---|---|---|

Non-sinusoidal orthogonal basis function - Haar Tansform - Walsh transform - Hadamard Transform - Slant Transform – Applications

| Module:5 | Statistics based transforms: | 4 hours | SLO: 9 |
|---|---|---|---|

KL transform - Singular value decomposition – Applications

| Module:6 | Directional Transforms: | 6 hours | SLO: 1 |
|---|---|---|---|

Hough transform - Radon transform - Ridgelet transform - Contourlet transform – Applications

| Module:7 | Wavelet Transform: | 6 hours | SLO: 1 |
|---|---|---|---|

Continuous Wavelet Transform - Multi-resolution Analysis - Image Compression - Image Coding - SPIHT - JPEG2000 - Wavelet based denoising - Watermarking - Applications.

| Module:8 | Contemporary issues: | 3 hours | |
|---|---|---|---|

| | | | |
|---|---|---|---|
| | **Total Lecture hours:** | **45 hours** | |
| **Text Book(s)** | | | |
| 1. | Rafael C. Gonzalez, Digital Image Processing, Pearson Education, New Delhi, 2013 | | |
| **Reference Books** | | | |
| 1. S. Sridhar, Digital Image Processing, Oxford University Press, Sixth impression, New Delhi, 2014 | | | |
| Recommended by Board of Studies | 05-03-2016 | | |
| Approved by Academic Council | No. 40 | Date | 18-03-2016 |

| Course code | Principles and Practices of Communication System | L | T | P | J | C |
|---|---|---|---|---|---|---|
| ITE2003 | | 3 | 0 | 0 | 4 | 4 |
| Pre-requisite | ITE1001 | Syllabus version | | | | |
| | | 1.00 | | | | |

**Course Objectives:**

- To understand various devices used in Analog Communication
- To understand the impact of interference to signaling devices
- To understand the various issues in communication systems

**Expected Course Outcome:**

- Design and construct devices used in Communication Systems
- Address the challenges imposed in different types of Communication Systems

**Student Learning Outcomes (SLO):** 2,6,14

| Module:1 | Amplitude Modulation Systems | 6 hours | SLO: 2 |
|---|---|---|---|

Review of Spectral Characteristics of Periodic and Non-periodic signals; Generation and Demodulation of AM, DSBSC, SSB and VSB Signals; Comparison of Amplitude Modulation Systems

| Module:2 | Angle Modulation Systems | 6 hours | SLO: 2 |
|---|---|---|---|

Frequency Translation; Non – Linear Distortion; Phase and Frequency Modulation; Single tone, Narrow Band and Wideband FM; Transmission Bandwidth; Generation and Demodulation of FM Signal, FDM and OFDM

| Module:3 | Fundamentals of Noise Theory | 5 hours | SLO: 6 |
|---|---|---|---|

Review of Probability, Random Variables and Random Process; Gaussian ProcessShot noise, Thermal noise and white noise; Narrow band noise, Noise margin; Noise temperature; Noise Figure

| Module:4 | Performance of Continuous Wave Modulation Systems | 5 hours | SLO: 14 |
|---|---|---|---|

Super heterodyne Radio receiver and its characteristic; SNR; Noise in DSBSC systems using coherent detection; Noise in AM system using envelope detectionEnvelop Detection for FM; FM threshold effect; Pre-emphasis and De-emphasis in FM; Comparison of performances.

| Module:5 | Digital Communication | 7 hours | SLO: 6 |
|---|---|---|---|

Introduction, Shannon limit for information capacity, digital amplitude modulation, frequency shift keying,FSK bit rate and baud, FSK transmitter, BW consideration of FSK, FSK receiver, phase shift keying –binary phase shift keying QPSK, Quadrature Amplitude modulation, bandwidth efficiency, carrier recovery types- squaring loop, Costas loop, DPSK.

| Module:6 | Digital Transmission | 6 hours | SLO: 14 |
|---|---|---|---|

Introduction, Pulse modulation, PCM sampling, sampling rate, signal to quantization noise rate,companding analog and digital percentage error, delta modulation, adaptive delta modulation,differential pulse code modulation, pulse transmission types-Intersymbol interference, eye patterns.

| Module:7 | Satellite and Optical Communication | 8 hours | SLO: 2 |
|---|---|---|---|

Satellite Communication Systems Keplers Law, LEO and GEO Orbits, footprint, Link model-Optical Communication Systems-Elements of Optical Fiber Transmission link, Types, Losses, Sources and Detectors.

| | | | |
|---|---|---|---|
| **Module:8** | **Contemporary issues:** | **2 hours** | |
| | | | |
| | | | |
| | **Total Lecture hours:** | **45 hours** | |

| | |
|---|---|
| **Text Book(s)** | |
| 1. | Analog and Digital Communications, SudakshinaKundu, Pearson Education 2010. |
| **Reference Books** | |
| 1. | Herbert Taub& Donald L Schilling, Principles of Communication Systems, Third Edition, Tata McGraw Hill, 2013. |
| 2. | Wayne Tomasi, Advanced Electronic Communication Systems, Sixth edition, PearsonEducation, 2011 |
| 3. | Bruce Carlson, Communication Systems, Third Edition, McGraw Hill. |
| 4. | B.P.Lathi, Modern Digital and Analog Communication Systems, Third Edition, Oxford, 2011. |

| | | | |
|---|---|---|---|
| Recommended by Board of Studies | 05-03-2016 | | |
| Approved by Academic Council | No. 40 | Date | 18-03-2016 |

| Course code | Software Testing | L | T | P | J | C |
|---|---|---|---|---|---|---|
| ITE2004 | | 3 | 0 | 0 | 4 | 4 |
| Pre-requisite | ITE1005 | Syllabus version | | | | |
| | | 1.00 | | | | |

**Course Objectives:**

- To introduce Testing Concepts and Evolution
- To explain Testing Strategies and their usage
- To discuss the levels of testing
- To introduce Organizational features and Policies of Testing
- To discuss the Quality related issues

**Expected Course Outcome:**

- Understand the role of tester
- Apply mathematical logic for testing
- Choose appropriate testing strategies
- Communicate effectively with developers and other stakeholders
- Check and verify the Quality standards

**Student Learning Outcomes (SLO):** 2,7

| Module:1 | Introduction | 6 hours | SLO: 2 |
|---|---|---|---|

Basic definitions-software testing principles- Role of tester- testing as a process- Overview of Testing maturity model- Defects -Hypothesis and tests

| Module:2 | Black box testing strategies | 6 hours | SLO: 7 |
|---|---|---|---|

Black-Box Testing Techniques- Random testing- Equivalent partitioning-Boundary Value Analysis (BVA)- Equivalence Class Testing - State Transition Testing - Cause-Effect Graphing Based Testing - Error Guessing -Black box TMM Maturity goals

| Module:3 | White box testing strategies | 6 hours | SLO: 2 |
|---|---|---|---|

White-Box Testing Techniques- Test adequacy Criteria – coverage and control flow graphs- Basis Path Testing - - Loop Testing - Data Flow Testing - Mutation Testing Evaluating adequacy – white box and TMM levels

| Module:4 | Levels of testing- Phase-I | 6 hours | SLO: 2 |
|---|---|---|---|

Unit testing – Need- Functions- Plan –Design-Considerations – Test Harness, Integration testing-Goals-Strategies-Design- Plan-System testing

| Module:5 | Levels of testing- Phase– II | 6 hours | SLO: 2 |
|---|---|---|---|

Function test- Performance test-Stress test-Configuration test- Security test – Recovery test, Regression testing-Alpha - beta - Acceptance test- Special role of Use cases- levels of testing and TMM.

| Module:6 | Testing policies and organization | 6 hours | SLO: 7 |
|---|---|---|---|

Test planning- Components- Attachments-Locating test items- Test reports- Role of three critical groups-Building a test group- Structure- Technical training- Career paths- Certification-Integrating Testing Activities.

| Module:7 | Software quality | 6 hours | SLO: 2 |
|---|---|---|---|

Quality concepts- Cost estimation- Quality control- Role of operational Profiles and Usage models-statistical testing -Software Reliability –Measurements- applying reliability models-Confidence level-Usability Testing-Software quality control and critical views

| | | | |
|---|---|---|---|
| **Module:8** | **Contemporary issues:** | **3 hours** | |
| | | | |
| | | | |
| | **Total Lecture hours:** | **45 hours** | |

| | |
|---|---|
| **Text Book(s)** | |
| 1. | Ilene Burnstein, Practical Software Testing, Springer Verlag International Edition, Springer (India) Pvt Ltd, 2012. |
| **Reference Books** | |
| 1. | NareshChauhan, Software Testing Principles and Practices,Oxford University Press, 2013. |

| | | | |
|---|---|---|---|
| Recommended by Board of Studies | 05-03-2016 | | |
| Approved by Academic Council | No. 40 | Date | 18-03-2016 |

| Course code | Advanced Java Programming | L | T | P | J | C |
|---|---|---|---|---|---|---|
| ITE2005 | | 3 | 0 | 2 | 0 | 4 |
| Pre-requisite | ITE1002 | Syllabus version | | | | |
| | | 1.00 | | | | |

**Course Objectives:**

- To learn the Advanced concepts in J2SE
- To understand Web Application Development, Database Connectivity and its implementation using Servlets, JSP and JDBC
- To introduce advanced Java frameworks for improving the web application design

**Expected Course Outcome:**

- Understand and implement advanced Java concepts
- Develop Java based Web applications using Servlets and JSP
- Incorporate cutting-edge frameworks in web application development

**Student Learning Outcomes (SLO):** 2,5,17

| Module:1 | Introduction to Java Programming: | 6 hours | SLO:2 |
|---|---|---|---|

Features of Java, Data Types, Variables, Operators, Arrays, Control Statements. Introducing Classes and Objects, Methods, Inheritance, Packages and Interfaces, Exception Handling, Inner classes, String Handling

| Module:2 | Exploring Core Java | 6 hours | SLO:5 |
|---|---|---|---|

Multithreaded Programming, Files and IO Streams, Object Serialization ,Applets , Java GUI Programming and Event Handling, Java Networking, RMI, Reflection, Collections, Generics, Java Autoboxing and Annotations

| Module:3 | Introducing JavaEE | 6 hours | SLO: 17 |
|---|---|---|---|

Enterprise Java, Basic Application Structure, Using Web Containers, Creating Servlets, Configuring Servlets, Understanding HTTP methods, Using Parameters and Accepting Form Submissions, Using Init parameters, File Uploading, JDBC

| Module:4 | Java Server Pages | 6 hours | SLO: 17 |
|---|---|---|---|

Creating JSPs, Using Java within JSP, Combining Servlets and JSPs, Maintaining State using Sessions, JSP 2.0 EL, Using Javabeans components in JSP Documents, JSP Custom Tag Library, Integrating Servlets and JSP: Model View Controller Architecture

| Module:5 | Struts Framework | 6 hours | SLO: 17 |
|---|---|---|---|

Introduction to Struts – Building a Simple Struts Application – Understanding Model, View and Controller Layer- Overview of Tiles

| Module:6 | Java Server Faces(JSF) | 7 hours | SLO: 17 |
|---|---|---|---|

Introduction to Java Server Faces (JSF)- JSF Application Architecture – Building a simple JSF Application - JSF Request Processing Lifecycle – The Facelets View Declaration Language – User Interface Component Model- JSF Event Model

| Module:7 | Spring Framework and Hibernate | 6 hours | SLO: 17 |
|---|---|---|---|

Understanding Inversion of Control (IoC), Aspect Oriented Programming (AOP) and Dependency Injection, MVC pattern for Web Applications, Spring Framework, Understanding Application Context, Bootstrapping Spring framework, Configuring Spring framework, Data Persistence, Object/relational Mapping, Hibernate ORM, Mapping Entities to Tables

| | | | |
|---|---|---|---|
| **Module:8** | **Contemporary issues:** | **2 hours** | |
| | | | |
| | | | |
| | **Total Lecture hours:** | **45 hours** | |

**Text Book(s)**

| | |
|---|---|
| 1. | Herbert Schildt, The Complete Reference-Java, Tata Mcgraw-Hill Edition, Eighth Edition, 2014. |

**Reference Books**

| | |
|---|---|
| 1. | Nicholas S. Williams, Professional Java for Web Applications, Wrox Press, 2014. |
| 2. | Ed Burns, Chris Schalk, JavaServer Faces 2.0, The Complete Reference, McGraw-Hill Publishers, 2010. |
| 3. | Christian Bauer, Gavin King, Gary Gregory, Java Persistence with Hibernate, 2015. |
| 4. | Craig Walls, Spring in Action Paperback, Manning Publications, 2014. |

**List of Challenging Experiments (Indicative)** **SLO: 2,5,17**

1. Write a program to read the First name and Last name of a person, his weight and height using command line arguments. Calculate the BMI Index which is defined as the individual's body mass divided by the square of their height.

| Category | BMI Range-Kg/$m^2$ |
|---|---|
| Underweight | <18.5 |
| Normal (healthy weight) | 18.5 to 25 |
| Overweight | 25 to 30 |
| Obese Class | Over 30 |

Display the name and display his category based on the BMI value thus calculated.

2. If there are 4 batches in BTech(IT) learning 'ITE101' course, read the count of the slow learners (who have scored <25) in each batch. Tutors should be assigned in the ratio of 1:4 (For every 4 slow learners, there should be one tutor). Determine the number of tutors for each batch. Create a 2-D jagged array with 4 rows to store the count of slow learners in the 4 batches. The number of columns in each row should be equal to the number of groups formed for that particular batch ( Eg., If there are 23 slow learners in a batch, then there should be 6 tutors and in the jagged array, the corresponding row should store 4, 4, 4, 4, 4,3). Use for-each loop to traverse the array and print the details. Also print the number of batches in which all tutors have exactly 4 students.

3. Write a program to read a chemical equation and find out the count of the reactants and the products. Also display the count of the number of molecules of each reactant and product.Eg., For the equation,

   2NaOH + H2SO4 -> Na2SO4+ 2H2O, the O/P should be as follows.

   Reactants are 2 moles of NaOH, 1 mole of H2SO4.

   Products are 1 mole of Na2SO4 and 2 moles of H2O.

4. (Bioinformatics: finding genes) Biologists use a sequence of letters A, C, T, and G to model a genome. A gene is a substring of a genome that starts after a triplet ATG and ends before a triplet TAG, TAA, or TGA. Furthermore, the length of a gene string is a multiple of 3 and the gene does not contain any of the triplets ATG, TAG, TAA, and TGA. Write a program that prompts the user to enter a genome and displays all genes in the genome. If no gene is found in the input sequence, displays no gene. Here are the sample runs:

| | |
|---|---|
| | Enter a genome string: TTATGTTTTAAGGATGGGGCGTTAGTT<br>O/P: TTT<br>GGGCGT |
| 5. | Create a class Film with string objects which stores name, language and lead_actor and category (action/drama/fiction/comedy). Also include an integer data member that stores the duration of the film. Include parameterized constructor, default constructor and accessory functions to film class.Flim objects can be initialized either using a constructor or accessor functions.Create a class FilmMain that includes a main function.In the main function create a vector object that stores the information about the film as o bjects.use the suitable methods of vector class to iterate the vector object to display the following<br>a. The English film(s) that has Arnold as its lead actor and that runs for shortest duration.<br>b. The Tamil film(s) with Rajini as lead actor.<br>c. All the comedy movies. |
| 6. | Define an abstract class 'Themepark' and inherit 2 classes 'Queensland' and 'Veegaland' from the abstract class. In both the theme parks, the entrance fee for adults is Rs. 500 and for children it is Rs. 300. If a family buys 'n' adult tickets and 'm' children tickets, define a method in the abstract class to calculate the total cost. Also, declare an abstract method playGame() which must be redefined in the subclasses.<br>In Queensland, there are a total of 30 games. Hence create a Boolean array named 'Games' of size 30 which initially stores false values for all the elements. If the player enters any game code that has already been played, a warning message should be displayed and the user should be asked for another choice. In Veegaland, there are a total of 40 different games. Thus create an integer array with 40 elements. Here, the games can be replayed, until the user wants to quit. Finally display the total count of games that were repeated and count of the games which were not played at all. |
| 7. | Read the Register Number and Mobile Number of a student. If the Register Number does not contain exactly 9 characters or if the Mobile Number does not contain exactly 10 characters, throw an IllegalArgumentException. If the Mobile Number contains any character other than a digit, raise a NumberFormatException. If the Register Number contains any character other than digits and alphabets, throw a NoSuchElementException. If they are valid, print the message 'valid' else 'invalid' |
| 8. | Within the package named 'primespackage', define a class Primes which includes a method checkForPrime() for checking if the given number is prime or not. Define another class named TwinPrimes outside of this package which will display all the pairs of prime numbers whose difference is 2. (Eg, within the range 1 to 10, all possible twin prime numbers are (3,5), (5,7)). The TwinPrimes class should make use of the checkForPrime() method in the Primes class. |
| 9. | Define a class 'Donor' to store the below mentioned details of a blood donor.<br>- Name, age, Address, Contactnumber, bloodgroup, date of last donation. Create 'n' objects of this class for all the regular donors at Vellore. Write these objects to a file. Read these objects from the file and display only those donors' details whose blood group is 'A+ve' and had not donated for the recent six months. |
| 10. | Three students A, B and C of B.Tech-IT II year contest for the PR election. With the total strength of 240 students in II year, simulate the vote casting by generating 240 random numbers (1 for student A, 2 for B and 3 for C) and store them in an array. Create four threads to equally share the task of counting the number of votes cast for all the three candidates. |

| | |
|---|---|
| | Use synchronized method or synchronized block to update the three count variables. The main thread should receive the final vote count for all three contestants and hence decide the PR based on the values received. |
| 11. | Draw a ball, filled with default color. Move the ball from top to bottom of the window continuously with its color changed for every one second. The new color of the ball for the next second should be obtained by adding 20 to the current value of Red component, for the second time by adding 20 to the blue component, and for the third time by adding 20 to the blue component, till all reach the final limit 225, after which the process should be repeated with the default color. |
| 12. | Develop a UDP based client-server application to notify the client about the integrity of data sent from its side.<br>Check sum calculation:<br>1. Add the 16-bit values up. Each time a carry-out (17th bit) is<br>produced, swing that bit around and add it back into the LSb (one's digit).<br><br>2. Once all the values are added in this manner, invert all the bits in the result.<br><br>For example, separate the data into groups of 4 bits only for readability.<br><br>1000 0110 0101 1110<br>1010 1100 0110 0000<br>0111 0001 0010 1010<br><br>First, add the 16-bit values 2 at a time:<br><br>1000 0110 0101 1110 First 16-bit value<br>+ 1010 1100 0110 0000 Second 16-bit value<br>---<br>1 0011 0010 1011 1110 Produced a carry-out, which gets added<br>+ \----------> 1 back into LBb<br>---<br>0011 0010 1011 1111<br>+ 0111 0001 0010 1010 Third 16-bit value<br>---<br>0 1010 0011 1110 1001 No carry to swing around (**)<br><br>---<br>0010 0101 1001 1111 Our "one's complement sum"<br><br>Then take the one's complement of the sum which is<br><br>1101 1010 0110 0000 The "one's complement"<br><br>So the checksum stored in the header should be 1101 1010 0110 0000. |
| 13. | Develop an RMI application to invoke a remote method that takes two numbers and returns true if one number is an exact multiple of the other and false otherwise.<br>Eg., 5 and 25 -> true<br>26 and 13 -> true<br>4 and 18 -> false |
| 14. | a)Assume two cookies are created whenever a VIT student visits the VIT webpage-one for |

| | | | | |
|---|---|---|---|---|
| | his/her name and the other for his campus. For subsequent visits, he/she should be greeted with the message similar to the one below<br>"Hi Ajay from Chennai Campus!!".<br>Write a servlet program to do the needful.<br>b)Build an application using JSF framework to implement a Celsius to Fahrenheit converter.<br>Note: Fahrenheit=(Celsius*9/5)+32 | | | |
| 15. | Using Hibernate framework, simulate the course registration process for Advanced Java Programming. Let the registration number and name of the students who register for the course, be stored in a database. The tool should allow deletion of the registered course for a particular student, if he/she wishes. At any instant, the list of students who have registered for the course should be displayed, if requested for. | | | |
| | | | Total Laboratory Hours | 30 hours |
| Recommended by Board of Studies | 12-08-2017 | | | |
| Approved by Academic Council | No. 47 | Date | 05-10-2017 | |

| Course code | Data Mining Techniques | L | T | P | J | C |
|---|---|---|---|---|---|---|
| ITE2006 | | 3 | 0 | 0 | 4 | 4 |
| Pre-requisite | ITE1003 | Syllabus version | | | | |
| | | 1.00 | | | | |

**Course Objectives:**

- To understand the fundamental data mining methodologies and with the ability to formulate and solve problems
- To comprehend the overall architecture of a data warehouse and techniques and methods for data gathering and data pre-processing
- To learn practical, efficient and statistically sound techniques, capable of solving real world issues

**Expected Course Outcome:**

- Store voluminous data for online processing
- Pre-process the data for mining applications
- Apply the association rules for mining the data
- Design and deploy appropriate classification techniques
- Cluster the high dimensional data for better organization of the data

**Student Learning Outcomes (SLO):** 1,2,14

| Module:1 | Introduction | 6 hours | SLO: 2 |
|---|---|---|---|

Data Mining – Stages of the Data Mining Process – Data Mining Knowledge Representation - Technologies – Major Issues in Data Mining- Data Warehousing- Multidimensional data – OLAP Vs OLTP

| Module:2 | Data Preprocessing | 6 hours | SLO: 1 |
|---|---|---|---|

Data cleaning - Data reduction - Data Integration - Data Transformation – Feature Selection – Dimensionality Reduction- Discretization and generating concept hierarchies

| Module:3 | Data mining knowledge representation | 6 hours | SLO: 2 |
|---|---|---|---|

Task relevant data -Interestingness measures - Representing input data and output knowledge - Visualization techniques

| Module:4 | Mining Frequent Patterns, Associations and Correlations | 6 hours | SLO: 14 |
|---|---|---|---|

Market Basket Analysis – Frequent Item Set Mining methods- Apriori algorithm –Generating Association Rules- A Pattern Growth Approach – Association Analysis to Correlation Analysis

| Module:5 | Data Mining Algorithms : Classification | 6 hours | SLO: 14 |
|---|---|---|---|

Basic concepts – Bayesian Classification Methods -Decision Tree Induction – Rule based Classification -Experiments with Weka.

| Module:6 | Advanced Classification Methods | 6 hours | SLO: 14 |
|---|---|---|---|

Bayesian Belief Networks- Classification by Back propagation- Lazy Learners- Genetic Algorithm – Rough Set Approach.

| Module:7 | Clustering | 6 hours | SLO: 14 |
|---|---|---|---|

Basic issues in clustering - Partitioning methods- K-means, K-Medoids - Hierarchical methods: distance-based agglomerative and divisible clustering- Density Based Methods

| Module:8 | Contemporary issues: | 3 hours | SLO: 2 |
|---|---|---|---|

| | | | |
|---|---|---|---|
| | **Total Lecture hours:** | **45 hours** | |

**Text Book(s)**

| | |
|---|---|
| 1. | J. Han and M. Kamber, Data Mining: Concepts and Techniques, Third Edition,Morgan Kaufman, 2013. |

**Reference Books**

| | |
|---|---|
| 1. | Charu C. Aggarwal, Data Mining: The Textbook, Springer, 2015. |
| 2. | Zaki and Meira, Data Mining and Analysis Fundamental Concepts and Algorithms, 2014 |
| 3. | G. K. Gupta, Introduction to Data Mining with Case Studies, Easter Economy Edition, Prentice Hall of India, 2014. |

| | | | |
|---|---|---|---|
| Recommended by Board of Studies | 05-03-2016 | | |
| Approved by Academic Council | No. 40 | Date | 18-03-2016 |

| Course code | Storage Technologies | L | T | P | J | C |
|---|---|---|---|---|---|---|
| ITE2009 | | 3 | 0 | 0 | 4 | 4 |
| Pre-requisite | ITE1003 | Syllabus version | | | | |
| | | 1.00 | | | | |

**Course Objectives:**

- To provide better understanding of guidelines, principles, and architecture used in storage technology
- To provide an insight into the technologies in storage management, thereby presenting the end user with through knowledge in designing secure storage system

**Expected Course Outcome:**

- Apply the storage technology, principles and design for various applications
- Recognize storage issues and overcome the issues in storage
- Identify and choose from a variety of user research and evaluation techniques

**Student Learning Outcomes (SLO):** 2,5,12

| Module:1 | Introduction to Information Storage and Management | 6 hours | SLO: 2 |
|---|---|---|---|

Information storage, Evolution of storage technology and architecture, Data center infrastructure, Key challenges in managing information, Information lifecycle

| Module:2 | Storage System Environment | 6 hours | SLO: 5 |
|---|---|---|---|

Components of a storage system environment, Disk drive components, Disk drive performance and fundamental laws of governing disk performance, Logical components of the Host, Application requirements and disk performance

| Module:3 | Data Protection using RAID | 6 hours | SLO: 5 |
|---|---|---|---|

RAID and its implementation aspects, RAID array components, RAID levels and comparison, RAIP impact of disk performance, Hot spares

| Module:4 | Intelligent Storage System | 6 hours | SLO: 5 |
|---|---|---|---|

Components of an intelligent storage system, intelligent storage array, Concepts in practice

| Module:5 | Direct-attached storage and introduction to SCSI | 6 hours | SLO: 5 |
|---|---|---|---|

Benefits, limitations and types of direct-attached storage (DAS), Disk drive interfaces, Introduction to SCSI and its command model.

| Module:6 | Storage Area Networks | 6 hours | SLO: 5 |
|---|---|---|---|

Fiber channel, Evolution and components of SAN, Fiber channel (FC), connectivity, FC ports and architecture, Zoning, FC login types, FC topologies.

| Module:7 | Network-attached storage | 6 hours | SLO: 12 |
|---|---|---|---|

General purpose servers versus network attached storage (NAS) devices, NAS file I/O, NAS components and implementation, NAS file-sharing protocols and I/O operations, Factors affecting NAS performance and availability

| Module:8 | Contemporary issues: | 3 hours | |
|---|---|---|---|

| | | | |
|---|---|---|---|
| | **Total Lecture hours:** | **45 hours** | |

| | |
|---|---|
| **Text Book(s)** | |
| 1. | SomasundaramGnanasundaram, AlokShrivastava,Information Storage and Management, Wiley Publishing Inc, 2nd Edition ,2012. |
| **Reference Books** | |
| 1. | Data Storage Networking: Real World Skills for the CompTIA Storage+ Certification and Beyond Nigel Poulton John Wiley & Sons, 2014. |
| 2. | Storage Networks Explained Ulf Troppens, Rainer Erkens, Wolfgang Muller-Friedt, Rainer Wolafka, Nils HausteinJohn Wiley & Sons, 24-Aug-2011 |
| 3. | Securing Storage: A Practical Guide to SAN and NAS Security HimanshuDwivedi, Prentice Hall ,2012. |

| | | | |
|---|---|---|---|
| Recommended by Board of Studies | 05-03-2016 | | |
| Approved by Academic Council | No. 40 | Date | 18-03-2016 |

| Course code | Artificial Intelligence | L | T | P | J | C |
|---|---|---|---|---|---|---|
| ITE2010 | | 3 | 0 | 0 | 4 | 4 |
| Pre-requisite | ITE1006 | Syllabus version | | | | |
| | | 1.00 | | | | |

**Course Objectives:**

- To understand and explain the basics of Artificial Intelligence.
- To improve problem solving techniques, knowledge representation and reasoning systems capability.
- To gain knowledge for developing Expert systems.

**Expected Course Outcome:**

- Learn various Artificial Intelligence techniques and their areas of applications.
- Solve various practical problems using Artificial Intelligencetechniques.
- Develop expert system for various applications.
- Learn to take decision under uncertainties.

**Student Learning Outcomes (SLO): 1,2,9**

| Module:1 | AI-Foundations | 5 hours | SLO: 2 |
|---|---|---|---|

History-Intelligent Agents –Types - AI Techniques –Data and Knowledge- Problem Solving.

| Module:2 | Problem Spaces and Search: | 7 hours | SLO: 2 |
|---|---|---|---|

Search Problem – Production Rules – Breadth-First Search(BFS) – Depth-First Search(DFS) – Solution of search problems by BFS and DFS – Travelling Salesman Problem – Merits and Demerits of BFS and DFS.

| Module:3 | Heuristic Search | 8 hours | SLO: 1 |
|---|---|---|---|

Generate-and-Test – Hill Climbing — Steepest-Ascent Hill Climbing –Local maximum, Plateau and Ridge - Best-First Search – OR- Graphs - AND-OR Graphs – Problem Reduction – Constraint Satisfaction – Cryptarithmetic Problem.

| Module:4 | Knowledge Representation | 6 hours | SLO: 2 |
|---|---|---|---|

Representations and Mappings – Approaches to Knowledge Representation – Important Attributes : instance and is a - Property Inheritance – Inheritable Knowledge – Slot-and-Filter Structure – Queries.

| Module:5 | Predicate Logic | 7 hours | SLO: 9 |
|---|---|---|---|

Representing Facts in Logic (wff ‘ s) – Conversion of wff ‘ s to Clause Form – Resolution – Propositional Resolution – Problems using Propositional Resolution- The Unification.

| Module:6 | Uncertainty-Probabilistic Reasoning | 5 hours | SLO: 9 |
|---|---|---|---|

Prior and Posterior Probabilities - Making simple and complex decisions – Bayes’ Theorem - Nonmonotonic reasoning and Justification-Based Truth Maintenance System (TMS).

| Module:7 | Planning and Learning | 4 hours | SLO: 2 |
|---|---|---|---|

Representation for planning-Partial orderplanning – Total order Planning – Learning – Learning by -Analyzing Differences-Explaining Experiences - Correcting Mistakes.

| | | | |
|---|---|---|---|
| **Module:8** | **Contemporary issues:** | **3 hours** | |
| | | | |
| | | | |
| | **Total Lecture hours:** | **45 hours** | |

| | |
|---|---|
| **Text Book(s)** | |
| 1. | Elaine Rich and Kevin Knight, Artificial Intelligence, Third Edition,Tata McGraw Hill,2008. |
| **Reference Books** | |
| 1. | Patrick Henry Winston, Artificial Intelligence, Third Edition, Addison Wesley, 2011. |
| 2. | Stuart J. Russell and Peter Norvig, Artificial Intelligence: A Modern Approach, Third Edition, PHI, 2015. |

| | | | |
|---|---|---|---|
| Recommended by Board of Studies | 05-03-2016 | | |
| Approved by Academic Council | No. 40 | Date | 18-03-2016 |

| Course code | Machine Learning | L | T | P | J | C |
|---|---|---|---|---|---|---|
| ITE2011 | | 3 | 0 | 0 | 4 | 4 |
| Pre-requisite | ITE1015 | Syllabus version | | | | |
| | | 1.00 | | | | |

**Course Objectives:**

- To enable students to understand different techniques related to Machine Learning.
- To make students become acquainted with sequential decision-making methods in ML.
- To gain basic knowledge about the key algorithms and theory that forms the foundation of machine learning.

**Expected Course Outcome:**

- To analyze the principles, advantages, limitations and possible applications of machine learning.
- Decide the suitable machine learning methods/algorithms for various type of learning problems
- Apply the algorithms to a real-world problem, optimize the models learned and report on the expected accuracy that can be achieved by applying the models.

**Student Learning Outcomes (SLO): 2,4,18**

| Module:1 | Basics | 5 hours | SLO: 2 |
|---|---|---|---|

Definition-Machine Learning, Classification, Supervised/Unsupervised Learning, Probably Approximately Correct (PAC) Learning

| Module:2 | Bayesian Decision Theory | 6 hours | SLO: 4 |
|---|---|---|---|

Classification, Losses and Risks, Discriminant Functions, Utility Theory, Evaluating an Estimator: Bias and Variance, The Bayes' Estimator, Parametric Classification, Model Selection Procedures

| Module:3 | Multivariate Methods | 7 hours | SLO: 2 |
|---|---|---|---|

Multivariate Data - Parameter Estimation - Estimation of Missing Value - Multivariate Normal Distribution - Multivariate Classification - Multivariate Regression - Dimensionality Reduction- Factor Analysis - Multidimensional Scaling - Locally Linear Embedding

| Module:4 | Clustering | 7 hours | SLO: 2 |
|---|---|---|---|

k-Means Clustering - Mixtures of Latent Variable Models - Hierarchical Clustering - Nonparametric Methods : Nonparametric Density Estimation - k-Nearest Neighbor Estimator - Nonparametric Classification - Smoothing Models

| Module:5 | Decision Trees | 6 hours | SLO: 2 |
|---|---|---|---|

Univariate Trees - Pruning - Rule Extraction from Trees - Multivariate Trees - Linear Discrimination : Generalizing the Linear Model - Logistic Discrimination - Discrimination by Regression

| Module:6 | Multilayer Perceptrons | 6 hours | SLO: 18 |
|---|---|---|---|

Neural Networks - Training a Perceptron - Learning Boolean Functions - Multilayer Perceptrons - Back propagation Algorithm - Training Procedures - Tuning the Network Size - Radial Basis Functions

| Module:7 | Kernel Machines | 6 hours | SLO: 18 |
|---|---|---|---|

Optimal Separating Hyperplane - The Nonseparable Case: Soft Margin Hyperplane - v-SVM - Kernel Machines for Regression- One-Class Kernel Machines - Kernel Dimensionality Reduction.

| | | | |
|---|---|---|---|
| **Module:8** | **Contemporary issues:** | **2 hours** | |
| | | | |
| | | | |
| | **Total Lecture hours:** | **45 hours** | |

| | |
|---|---|
| **Text Book(s)** | |
| 1. | Ethem Alpaydi, Introduction to Machine Learning, Second Edition, The MIT Press, 2015 |
| **Reference Books** | |
| 1. | Russell and Norvig, Artificial Intelligence, Third Edition, Prentice Hall, 2015 |
| 2. | Mitchell, Tom, Machine Learning, Tata McGraw-Hill, 2017 |

| | | | |
|---|---|---|---|
| Recommended by Board of Studies | 05-03-2016 | | |
| Approved by Academic Council | No. 40 | Date | 18-03-2016 |

| Course code | .Net-Programming | L | T | P | J | C |
|---|---|---|---|---|---|---|
| ITE2012 | | 3 | 0 | 2 | 0 | 4 |
| Pre-requisite | ITE1002 | Syllabus version | | | | |
| | | 1.00 | | | | |

**Course Objectives:**

- To understand the fundamentals of developing modular application by using object oriented concepts.
- To utilize the C# and .NET framework to build distributed enterprise applications.
- To develop Console application, windows application, ASP.NET Web application and Services.
- To connect to multiple data sources and managing them effectively.

**Expected Course Outcome:**

- Design windows and web applications for enterprise.
- Create database driven applications and web services.
- Implement client/server model for any application.

**Student Learning Outcomes (SLO):** 1,2,5

| Module:1 | .NET Framework | 5 hours | SLO: 2 |
|---|---|---|---|

Common language Runtime (CLR) – Common Type System (CTS) – Common language Specification (CLS) – Compilation process – Assemblies – Namespaces – Command line compiler.

| Module:2 | C# language fundamentals | 6 hours | SLO: 5 |
|---|---|---|---|

Programming constructs – value types and reference types – object oriented concepts – Encapsulation – Inheritance – polymorphism – Interfaces – collections – Multithreading.

| Module:3 | File I/O and Attribute based Programming | 6 hours | SLO: 5 |
|---|---|---|---|

Console Application – Indexers - Multicast delegates – Events - Registry programming – File I/O - Serialization – Binary format – SOAP format – Type Reflection and attribute-based programming – Late binding.

| Module:4 | Graphics and Windows Forms | 6 hours | SLO: 1 |
|---|---|---|---|

Tool box controls – Container control – Menu – Tool bar – Tool tip Controls during design time – Run time – Graphics programming GDI+.

| Module:5 | Networking | 6 hours | SLO: 5 |
|---|---|---|---|

Remoting – Architecture - Marshal By value (MBV) – Marshal By Reference (MBR) – Network programming using C# - Socket – TCP – UDP

| Module:6 | Database Programming | 7 hours | SLO: 5 |
|---|---|---|---|

Data Access with ADO.NET – Architecture – Data reader – Data Adapter – Command – Connection – Data set – Data binding – Data Grid Control – XML based Data sets.

| Module:7 | Web Development | 6 hours | SLO: 5 |
|---|---|---|---|

Web Development and ASP.NET – Architecture – web forms – web form controls – Life time Management - Application – Session – ASP with ADO.NET Validation controls – website security.

| Module:8 | Contemporary issues: | 3 hours | |
|---|---|---|---|

| | | | |
|---|---|---|---|
| | **Total Lecture hours:** | **45 hours** | |

| | |
|---|---|
| **Text Book(s)** | |
| 1. | Andrew Troelsen, Pro C# 5.0 and the .NET 4.5 Framework, Sixth edition, A Press, 2012. |
| **Reference Books** | |
| 1. | Joh Skeet, C# in depth, Manning publications, Third Edition, 2014. |
| 2. | Adrew Stellman and Jennifer Greene, Head First C#, Third Edition, O'Reilly, 2013. |

| | | |
|---|---|---|
| **List of Challenging Experiments (Indicative)** | | **SLO: 1,2,5** |
| 1. | Create a DLL using VB.NET for ATM Object with necessary fields, properties and methods such as initiating, deposit and withdrawal. Write a menu driven program to perform the following in c#,<br>(i) Discover all the types that are available in the DLL using the concept of multicast delegates.<br>(ii) After initiating the basic information of the customer perform serialization using SOAP format.<br>(iii) Deserialize the above and invoke the methods such as deposit and withdrawal using the concept of late binding. While performing withdrawal, check for the minimum balance value that has to be retrieved from registry. |
| 2. | Create a DLL using VB.NET named Sum with overloaded methods such as,<br>Sum_a(double s, double t );<br><br>Sum_a(int i, int j);<br><br>Sum_a(int k, double b);<br><br>Write a menu driven program to perform the following using C#,<br><br>(i) Discover all the types that are available in the DLL using the concept of multicast delegates.<br>(ii) After initiating the values perform serialization using Binary format.<br>(iii)Deserialize the above and invoke the methods using the concept of late binding. If the signature of a method which is invoked is (double, double) then store the result value in registry. |
| 3. | Create a DLL using C# for foreign currency to Indian rupees convertor calculator with following specifications,<br><br>1 dollar = 65.58 Indian rupees<br><br>1 Euro = 73.47 Indian rupees<br><br>1 Saudi Riyal = 3.75 Indian rupees<br><br>1 Ringgit = 15.36 Indian rupees<br><br>1 Chinese Yuan = 1.49 Indian rupees<br><br>Write a Menu driven program using console application to invoke the above DLL with the |

| | |
|---|---|
| | below given functionalities using VB.NET<br><br>(i). Use the concept of multicast delegates to perform the above.<br><br>(ii). Store the latest calculated values of conversion done for all the above five in user defined registry.<br><br>(iii). Provide an option for displaying the largest conversion done foreign currency name with Rupee value stored in the registry. |
| 4. | Write a database program using ADO for students CAT Analysis system that performs various basic operations such as addition, modify, delete and viewing of student records. Also, provide an option for calculating the grades for the subjects based on the marks and display the results in grid control. |
| 5. | Develop a website for E-shopping with necessary functionalities. |
| 6. | Create a DLL for mobile phone object that has set of interfaces, properties, fields and methods related to it. Write a program to discover all the types available in the DLL using the concept of reflection and display it in windows form. |
| 7. | Create a generalized DLL that displays the signature information of any method which is passed as an input. |
| 8. | Develop a chat application using client/server programming. |
| 9. | Write a program using indexer for storing the temperature at various time of a day. Provide an option to retrieve the temperature at any given time. Store the maximum temperature of the day in registry. |
| 10. | Create a DLL for User Authentication System with methods and propertie. Using the concept of Remoting validate a user from the client side whereas, the user information has to be stored at the side of server Registry. |

| | | | |
|---|---|---|---|
| | | Total Laboratory Hours | 30 hours |
| Recommended by Board of Studies | 12-08-2017 | | |
| Approved by Academic Council | No. 47 | Date | 05-10-2017 |

| Course code | Big Data Analytics | L | T | P | J | C |
|---|---|---|---|---|---|---|
| ITE2013 | | 3 | 0 | 0 | 4 | 4 |
| Pre-requisite | ITE1003 | Syllabus version | | | | |
| | | 1.00 | | | | |

**Course Objectives:**

- To introduce Big Data and the Data analytics lifecycle to address business challenges that leverage big data.
- To understand the importance of mining data streams and social network graphs.
- To introduce big data analytics technology and tools including MapReduce and Hadoop.

**Expected Course Outcome:**

- Reframe a business challenge as an analytics challenge.
- Apply appropriate analytic techniques and tools to analyze big data.
- Create models and identify insights that can lead to actionable results.
- Effectively participate in big data and other analytics projects.
- Use tools such as MapReduce / Hadoop.

**Student Learning Outcomes (SLO): 7,14**

| Module:1 | Big Data Concepts and Environment | 6 hours | SLO: 7 |
|---|---|---|---|

Big Data Overview-Big Data Challenges and Opportunities- Data analytics lifecycle overview – Phases of Data Analytics: Discovery, Data preparation, Model planning, Model building, Communicate results, Operationalize – Case Study.

| Module:2 | Overview of Hadoop and HDFS | 6 hours | SLO: 7 |
|---|---|---|---|

Introduction to Hadoop - The Distributed File System: HDFS, GPFS – The Design of HDFS – HDFS-Concepts-Blocks, Name Nodes and Data Nodes; Components of Hadoop- Hadoop Cluster Architecture-Batch Processing- Serialization - Hadoop ecosystem of tools-NoSQL .

| Module:3 | Map Reduce | 6 hours | SLO: 7 |
|---|---|---|---|

MapReduce Basics - Functional Programming Roots - Mappers and Reducers - The Execution Framework -MapReduce Algorithm Design –Shuffling, Grouping, Sorting- Custom Partitioners and Combiners- MapReduce Formats and Features.

| Module:4 | Algorithms for Handling Big Data | 6 hours | SLO: 14 |
|---|---|---|---|

Random Forest Algorithm, Unstructured Data Analytics, Randomized Matrix Algorithms in Parallel and Distributed Environments, Mahout: Probabilistic Hashing for Efficient Search and Learning on Massive Data, Dirichlet process clustering, Latent Dirichlet Allocation, Singular value decomposition, Parallel Frequent Pattern mining, Complementary Naive Bayes classifier, Random forest decision tree based classifier.

| Module:5 | Lambda Architecture | 6 hours | SLO: 14 |
|---|---|---|---|

Different layers of Lambda Architecture, Data storage on the batch layer. Serving Layer- Requirements for a serving layer database, Indexing strategies. Speed Layer- Storing and Computing Real time views, Queuing and Streaming – Illustration using Cassandra data model.

| Module:6 | Big Data Clustering | 6 hours | SLO: 14 |
|---|---|---|---|

K-means Algorithms - K-Means Basics - Initializing Clusters for K-Means -Picking the Right Value of k - The Algorithm of Bradley, Fayyad, and Reina - Processing Data in the BFR Algorithm.

| Module:7 | Mining Social Network Graphs | 6 hours | SLO: 14 |
|---|---|---|---|

| | | | |
|---|---|---|---|
| Link Analysis: Page Rank- Efficient computation of Page Rank- Topic Sensitive Page Rank- Link Spam- Hubs and Authorities. Mining Social Network Graphs: Web Advertising: Online and Offline Algorithms; Social Network Graphs: Clustering of Social Network Graphs- Direct Discovery of Communities- Partitioning of Graphs- Finding overlapping communities- Simrank- Counting Triangles- Neighborhood properties of Graphs. | | | |
| | | | |
| **Module:8** | **Contemporary issues:** | **3 hours** | |
| | | | |
| | | | |
| | **Total Lecture hours:** | **45 hours** | |

**Text Book(s)**

| | |
|---|---|
| 1. | Paul C. Zikopoulos, Chris Eaton, Dirk deRoos, Thomas Deutsch, George Lapis, Understanding Big Data: Analytics for Enterprise Class Hadoop and Streaming Data, McGraw-Hill, 2015. |

**Reference Books**

| | |
|---|---|
| 1. | Lin and Chris Dyer, Data-Intensive Text Processing with MapReduce, Jimmy, Morgan & Claypool Synthesis, 2010. |
| 2. | Anand Rajaraman and Jeffrey David Ullman, Mining of Massive Datasets, Cambridge University Press, 2014. |
| 3. | Tom White, Hadoop, the Definitive guide, O'Reilly Media, 2015. |
| 4. | Noreen Burlingame, Little Book of Big Data, Ed. 2016. |

| | | | |
|---|---|---|---|
| Recommended by Board of Studies | 05-03-2016 | | |
| Approved by Academic Council | No. 40 | Date | 18-03-2016 |

| Course code | Software Project Management | L | T | P | J | C |
|---|---|---|---|---|---|---|
| ITE2014 | | 2 | 0 | 0 | 0 | 2 |
| Pre-requisite | ITE1005 | Syllabus version | | | | |
| | | 1.00 | | | | |

**Course Objectives:**

- To learn project management activities
- To learn cost benefit analysis for project evaluation
- To know network planning model for project scheduling
- To learn risk management techniques

**Expected Course Outcome:**

- Understand the fundamentals of software project management concepts and contemporary issues.
- Design a component or a product applying all the relevant standards and with realistic constraints.
- Use techniques, skills and modern Engineering tools necessary for engineering practices.

**Student Learning Outcomes (SLO):** 2,4,10

| Module:1 | INTRODUCTION TO SOFTWARE PROJECT MANAGEMENT | 3 hours | SLO: 2 |
|---|---|---|---|

Project Definition – Contract Management – Activities covered By Software Project Management – Overview of Project Planning – Stepwise Project Planning.

| Module:2 | PROJECT EVALUATION | 4 hours | SLO: 4 |
|---|---|---|---|

Strategic Assessment – Technical Assessment – Cost Benefit Analysis –Cash Flow Forecasting – Cost Benefit Evaluation Techniques – Risk Evaluation

| Module:3 | ACTIVITY PLANNING | 4 hours | SLO: 4 |
|---|---|---|---|

Objectives – Project Schedule – Sequencing and Scheduling Activities –Network Planning Models – Forward Pass – Backward Pass – Activity Float – Shortening Project Duration – Activity on Arrow Networks

| Module:4 | RISK MANAGEMENT | 4 hours | SLO: 4 |
|---|---|---|---|

Nature Of Risk – Types Of Risk – Managing Risk – Hazard Identification – Hazard Analysis – Risk Planning And Control

| Module:5 | MONITORING | 3 hours | SLO: 10 |
|---|---|---|---|

Creating Framework – Collecting The Data – Visualizing Progress – Cost Monitoring – Earned Value – Prioritizing Monitoring – Getting Project Back To Target

| Module:6 | CONTROL | 4 hours | SLO: 10 |
|---|---|---|---|

Change Control – Managing Contracts – Introduction – Types Of Contract – Stages In Contract Placement – Typical Terms Of A Contract – Contract Management – Acceptance.

| Module:7 | MANAGING PEOPLE AND ORGANIZING TEAMS | 5 hours | SLO: 10 |
|---|---|---|---|

Introduction – Understanding Behavior – Organizational Behavior: A Background – Selecting The Right Person For The Job – Instruction In The Best Methods – Motivation – The Oldham – Hackman Job Characteristics Model – Working In Groups – Becoming A Team –Decision

| | | | |
|---|---|---|---|
| Making – Leadership – Organizational Structures – Stress –Health And Safety – Case Studies. | | | |
| | | | |
| **Module:8** | **Contemporary issues:** | **3 hours** | |
| | | | |
| | | | |
| | **Total Lecture hours:** | **30 hours** | |

| | |
|---|---|
| **Text Book(s)** | |
| 1. | Bob Hughes, Mike Cotterell, Rajib Mall, Software Project Management, Fifth Edition, McGraw Hill, 2011 |
| **Reference Books** | |
| 1. | Greg Horine-Project Management Absolute Beginner's Guide, 3/E-Que Publishing ,2012 |

| | | | |
|---|---|---|---|
| Recommended by Board of Studies | 05-03-2016 | | |
| Approved by Academic Council | No. 40 | Date | 18-03-2016 |

| Course code | Information System Audit | L | T | P | J | C |
|---|---|---|---|---|---|---|
| ITE2015 | | 2 | 0 | 0 | 0 | 2 |
| Pre-requisite | ITE1005 | Syllabus version | | | | |
| | | 1.00 | | | | |

**Course Objectives:**

- To introduce information systems concepts
- To understand auditing standards
- To provide protective IT security guidelines for various types of Industries

**Expected Course Outcome:**

- Understand the role of the IS auditor and the IS audit function
- Understand the purpose of controls in an information systems environment.
- Evaluate asset safeguarding and data integrity, system effectiveness and system efficiency

**Student Learning Outcomes (SLO):** 2

| | | | |
|---|---|---|---|
| **Module:1** | **Overview of Information System** | **3 hours** | **SLO: 2** |
| Auditing-Conducting an Information Systems Audit - Overview & steps in an Audit. | | | |
| **Module:2** | **The Management Control Framework-I** | **4 hours** | **SLO: 2** |
| Introduction - Systems Development Management Controls - Approaches to Auditing Systems Development - Normative Models of the Systems Development Process - Evaluating the Major phases in the Systems Development Process | | | |
| **Module:3** | **The Management Control Framework-II** | **4 hours** | **SLO: 2** |
| Security Management Controls - Operations management Controls - Quality assurance Management Controls. | | | |
| **Module:4** | **The Application Control Framework** | **5 hours** | **SLO: 2** |
| Boundary Controls - Input Controls- Processing Controls - Database Controls - output Controls | | | |
| **Module:5** | **Evidence Collection** | **4 hours** | **SLO: 2** |
| Audit Software - Code Review - Test Data and Code Comparison - Concurrent Auditing techniques – Interviews -Questionnaires - Control Flowcharts- Performance Management tools. | | | |
| **Module:6** | **Evidence Evaluation** | **4 hours** | **SLO: 2** |
| Evaluating Asset Safeguarding and Data Integrity - Evaluating System Effectiveness - Evaluating System Efficiency. | | | |
| **Module:7** | **Information Systems Audit and Management** | **4 hours** | **SLO: 2** |
| Managing the Information Systems Audit Function - Planning Function - Organizing Function - Staffing Function - Leading Function - Controlling Function - Some Features of Information Systems Auditing – Troubleshooting the Audit Service. | | | |
| **Module:8** | **Contemporary issues** | **2 hours** | |
| | **Total Lecture hours:** | **30 hours** | |

**Text Book(s)**

1. CA. Manoj Agarwal, Information Systems Control and Audit, Fifth Edition, Bharat Law

| | | | | |
|---|---|---|---|---|
| | House, 2017 | | | |
| **Reference Books** | | | | |
| 1. | David L Cannon, Timothy S Beigmann, Brandy Pamplin, Certified Information System, Auditor study guide, Wiley Publications, 2011. | | | |
| 2. | JamesA.Hall, Information Technology Auditing and Assurance, Fourth Edition, South-Western College Pub, 2015. | | | |
| Recommended by Board of Studies | | 05-03-2016 | | |
| Approved by Academic Council | | No. 40 | Date | 18-03-2016 |

| Course code | Embedded Systems | L | T | P | J | C |
|---|---|---|---|---|---|---|
| ITE3002 | | 3 | 0 | 2 | 0 | 4 |
| Pre-requisite | ITE2001 | Syllabus version | | | | |
| | | 1.10 | | | | |

**Course Objectives:**

- To learn the fundamentals of embedded systems.
- To understand programs and tools for embedded systems.
- To impart knowledge about real time embedded systems
- To elucidate knowledge of embedded system types and its interfacing mechanisms

**Expected Course Outcome:**

- Design embedded system and device drivers
- Use software engineering practices in embedded systems development and Inter process communication.
- Incorporate Communication protocols in automobiles

**Student Learning Outcomes (SLO):** 2,4,17

| | | | |
|---|---|---|---|
| **Module:1** | **Introduction to Embedded Systems** | **6 hours** | **SLO: 2** |
| Application Areas- Categories of Embedded Systems-Overview of Embedded System Architecture-Specialties of Embedded Systems-Recent trends in Embedded Systems. | | | |
| **Module:2** | **Architecture of Embedded Systems** | **6 hours** | **SLO: 2** |
| Hardware Architecture-Software Architecture-Development / Testing Tools. | | | |
| **Module:3** | **Communication Interfaces** | **7 hours** | **SLO: 2** |
| Need for Communication Interfaces-RS232/UART- USB-IEEE 1394 Fire wire-Ethernet-IEEE 802.11-Bluetooth. | | | |
| **Module:4** | **Embedded / RTOS Concepts** | **7 hours** | **SLO: 4** |
| Architecture of Kernel- Tasks and task Schedulers-Interrupt service Routines-Semaphores-Mutex-Mail Boxes-Message Queues-Event registers-Timers-Memory Management-Priority Inversion Problem. | | | |
| **Module:5** | **Overview of Embedded / ROT System** | **7 hours** | **SLO: 17** |
| Embedded OS-RTOS-Handheld Oss-Representative embedded Systems. | | | |
| **Module:6** | **Future Trends** | **5 hours** | **SLO: 4** |
| Emerging Technologies- Pervasive / Ubiquitous. | | | |
| **Module:7** | **Security of Embedded systems** | **5 hours** | **SLO: 4** |
| Embedding Intelligence- Emerging Applications. | | | |
| **Module:8** | **Contemporary issues:** | **2 hours** | |
| | **Total Lecture hours:** | **45 hours** | |

**Text Book(s)**

1. Dr. K V K K Prasad, Embedded / Real-Time Systems: Concepts, Design And Programming, Black Book, DreamTech Press, 2016.

| **Reference Books** | |
|---|---|
| 1. | Wayner Wolf, Computers as components – Principles of embedded computing systemdesign, Morgan Kaufman, 2016 |
| 2. | Arnold S Berger, Embedded Systems Design: An Introduction to Processes, Tools &Techniques, CMP books, 2010. |
| 3. | Vahid F., Givargies T., Embedded Systems Design, Third Edition, John Wiley & Sons,paperback-2011. |
| 4. | Muhammad Ali Mazidi., Janice GillispieMazidi., The 8051 Microcontroller and EmbeddedSystems, Pearson Education Asia, 2012. |

| **List of Challenging Experiments (Indicative)** | **SLO: 2,4,17** |
|---|---|
| 1. | Generate and store the following series up to 'N' terms: Value of 'N' is available in location 30H. The series is presented using decimal number system. 1, 2,3,11,12,13,21,22,23,31... up to N terms. |
| 2. | A few random unsigned integers are stored from the internal data memory location 31H onwards. Number of terms (N) is available in location 30H. Assuming that none of these numbers is greater than 5, find the factorials of these integers and then find their sum. Assume that the sum would not exceed 8-bit value. |
| 3. | Create a new array by removing only those integers that are perfectly divisible by 4 from an array, starting from 31H. Location 30H contains number of terms of this array. The new array is to be created from the location 60H. At return, the accumulator should indicate number of terms found. Original locations with digits divisible by 4 should be replaced by null. |
| 4. | Write a subroutine to find the sum of the following series up to N terms. N is stored in location 30H. At return, the sum should be available in the accumulator. Assume that the value of N would not be more than 5.<br>(Term)=$n^3$-$(n-1)^2$<br>Sum= $(1^3-0^2)+(2^3-1^2)+(3^3-2^2)+$ up to N terms. |
| 5. | Some random hexadecimal numbers are stored from location 31H onwards. The number of terms (N) of the array is available in the location 30H. Convert all numbers to their corresponding BCD forms and store in their original locations. Assume no stored number is more than 63H. |
| 6. | Develop a subroutine to update the display of a clock that can be called at every minute. The clock should display hours and minutes in BCD format. After displaying 23.59, the display should be shown as 00.00. Assume that the hour count is stored at location 31H and the minute count in location 30H, both in packed BCD format. |

| | |
|---|---|
| 7. | A 4-digit BCD display should be shifted left by one digit in order to accumulate a freshly entered BCD digit available in the accumulator. Develop a subroutine to accomplish this task, assuming that locations 31H and 30H contain the higher and lower order numbers, respectively, in packed BCD format. |
| 8. | A portion of a written text is stored in the internal data memory location from 40H to 7FH so that it occupies 64 bytes. The text is in the form of ASCII and contains several words. ASCII character 'space' of code 20H separates any two words in the text. The text may or may not start with a space and may or may not end with a space. Multiple spaces are also possible in between the words and at the start and at the end. Develop a program to count the number of words within the text, and store this number in the accumulator. |
| 9. | There are 25 prime numbers between 2 and 100. Find a method to generate these prime numbers. |
| 10. | Find out another method of sorting, and compare its efficiency with the bubble sorting method. |
| 11. | A random array of integers was generated and stored from location 31H onwards, storing its number of terms at location 30H. However, although the algorithm generally does not permit the repeat of any integer, to check this, develop a program ensuring that there is no repetition of any term. In case of repetition, the program should come out with CY flag as set; otherwise, CY flag should be cleared. |
| 12. | Develop a program to generate prime numbers by the method of divisions. |
| | Total Laboratory Hours: 30 hours |

| | | | |
|---|---|---|---|
| Recommended by Board of Studies | 12-08-2017 | | |
| Approved by Academic Council | No. 47 | Date | 05-10-2017 |

| Course code | Parallel Processing | L | T | P | J | C |
|---|---|---|---|---|---|---|
| ITE3003 | | 3 | 0 | 0 | 4 | 4 |
| Pre-requisite | ITE2001 | Syllabus version | | | | |
| | | 1.00 | | | | |

**Course Objectives:**

- To learn to develop parallel algorithms and map them with processor architectures
- To understand the parallelization of basic mathematical and engineering algorithms
- To learn contemporary parallel architectures and their programming

**Expected Course Outcome:**

- To develop efficient parallel algorithms for scientific and engineering problems
- To design applications for modern parallel architectures

**Student Learning Outcomes (SLO):** 1,2,9

| Module:1 | Pram Algorithms | 9 hours | SLO: 2 |
|---|---|---|---|

Basics of Parallel Processing-Introduction to Flynn's Taxonomy-PRAM model of parallel computation - EREW-CREW-CRCW- Mapping theorem -Parallel reduction – prefix sums – list ranking – preorder tree traversal – merging two sorted lists – graph coloring – reducing processors –Brent's theorem.

| Module:2 | Processor Networks | 4 hours | SLO: 1 |
|---|---|---|---|

Mesh Networks – binary tree – hyper tree – pyramid – butterfly – hypercube – cube connected cycles and Shuffle exchange networks – De Brujin networks.

| Module:3 | Mapping and Scheduling | 5 hours | SLO: 1 |
|---|---|---|---|

Mapping data to processors: Embedding – Dilation – Ring to 2D mesh -2D mesh to 2Dmesh – Binary tree to 2D mesh – Binomial tree to 2Dmesh –Embedding graphs to hypercubes- binary tree to hypercubes – Binomial tree to hypercubes – rings and mesh to hypercubes. Static scheduling on UMA models. Grahams list scheduling algorithm. Coffman Grahams scheduling algorithm.

| Module:4 | Summation Algorithms | 5 hours | SLO: 9 |
|---|---|---|---|

Hypercube SIMD model – shuffle exchange SIMD summation algorithm – 2D Mesh SIMD summation algorithm – UMA summation model – Broadcast – Binomial tree communication pattern.

| Module:5 | Matrix Multiplication Algorithms | 6 hours | SLO: 9 |
|---|---|---|---|

Matrix multiplication on 2D Mesh SIMD model – Related theorems -Hypercube SIMD model – shuffle exchange SIMD model – UMA Multiprocessor – Block matrix multiplication – Algorithms for multicomputer – Row-column and block oriented algorithms.

| Module:6 | Sorting | 6 hours | SLO: 9 |
|---|---|---|---|

Enumeration sort – Lower bounds on Parallel sorting – Odd Even Transposition sort – Bitonic merge – sequence – Bitonic merge on shuffle exchange network – two dimensional mesh network – Hypercube network – Parallel quicksort – Recurrence equation and analysis – Hyperquick sort.

| Module:7 | Searchiing and Graph Algorithms | 7 hours | SLO: 9 |
|---|---|---|---|

Parallel search – Ellis's algorithm – Manber and Ladner's algorithms. P- Depth Search – Breadth Depth Search – Connected components –All pairs shortest path – single source shortest path – Minimum cost spanning tree – Sollin's algorithm – Kruskal's algorithm.

| | | | |
|---|---|---|---|
| **Module:8** | **Contemporary issues:** | **3 hours** | |
| | | | |
| | | | |
| | **Total Lecture hours:** | **45 hours** | |

| | |
|---|---|
| **Text Book(s)** | |
| 1. | Michael J. Quinn, Parallel computing theory and practice, McGraw Hill, Second Edition, 2012. |
| **Reference Books** | |
| 1. | David B. Kirk, Wen-mei W. Hwu, Programming Massively Parallel Processors: A Hands-on Approach, MK Publishers, 2010. |
| 2. | Pavan Balaji, Programming Models for Parallel Computing (Scientific and Engineering Computation) , MIT Press, 2016 |
| 3. | Patrick Amestoy, Daniela di Serafino, Rob Bisseling, Quitana Orti E.S., Vajtersic M, Parallel Numerical Algorithms, Springer, 2010 |

| | | | |
|---|---|---|---|
| Recommended by Board of Studies | 05-03-2016 | | |
| Approved by Academic Council | No. 40 | Date | 18-03-2016 |

| Course code | Distributed Systems | L | T | P | J | C |
|---|---|---|---|---|---|---|
| ITE3004 | | 3 | 0 | 0 | 4 | 4 |
| Pre-requisite | ITE2001 | Syllabus version | | | | |
| | | 1.00 | | | | |

**Course Objectives:**

- To explore the characteristics of Distributed systems and understand its features
- To impart knowledge about remote communication between processes or applications in heterogeneous environment
- To provide an exposure to commercial distributed Applications / tools / technologies

**Expected Course Outcome:**

- Design programs to meet the challenges in implementing distributed systems features
- Provide solutions to Reliability, Security, scalability and robustness in Internet
- Develop applications targeted for Internet considering the recent Paradigm such as Cloud

**Student Learning Outcomes (SLO):** 2,7,17

| | | | |
|---|---|---|---|
| **Module:1** | **Introduction** | **7 hours** | **SLO: 2** |
| Introduction to Distributed Systems – System Models – Networking and Internetworking – Inter process Communications - Case Study: IPC in UNIX | | | |
| **Module:2** | **Distributed Objects and File System** | **7 hours** | **SLO: 2** |
| Distributed Objects and Remote Invocation – Distributed File Systems -Architecture – Recent Advances | | | |
| **Module:3** | **Name Services and Directory Service** | **7 hours** | **SLO: 2** |
| Name services – Domain Name Systems – Coordination and Agreement – Time and Global states | | | |
| **Module:4** | **Transaction and Concurrency Control- Distributed Transactions** | **7 hours** | **SLO:7** |
| Transaction and Nested Transactions – Concurrency Control – Distributed Transactions | | | |
| **Module:5** | **Distributed OS and Shared Memory** | **5 hours** | **SLO: 2** |
| Distributed Operating System Support – Distributed Shared Memory- Web Services Overview | | | |
| **Module:6** | **Google search Engine** | **5 hours** | **SLO: 17** |
| Introduction: The Google Search Engine, crawling, Indexing, Ranking, Anatomy of Search Engine, Google as a cloud provider, Software as a service, Platform as a service.<br>Overall Architecture and Design Philosophy: Physical Model, Overall Infrastructure, Google Infrastructure<br>Underlying communication paradigm: Remote invocation, Supporting RPC, Publish- subscribe. | | | |
| **Module:7** | **Google File system** | **4 hours** | **SLO: 17** |
| Data Storage and coordination services: The Google file System [GFS], Chubby, BigTable.<br>Distributed Computation services: MapReduce, Sawzall | | | |
| **Module:8** | **Contemporary issues** | **3 hours** | |
| | | | |
| | | | |
| | **Total Lecture hours:** | **45 hours** | |

**Text Book(s)**

| | | | |
|---|---|---|---|
| 1. | Coulouris, J. Dollimore, and T. Kindberg, Distributed Systems:Concepts and Designs, Fifth Edition, Addison Wesley, 2012. | | |
| **Reference Books** | | | |
| 1. | Andrew.S.Tanenbaum, Maarten Van Steen, Distributed Systems –Principles and Paradigms, Third Edition, Prentice Hall -2016. | | |
| 2. | Mukesh Singhal and N. G. Shivaratri, Advanced Concepts in Operating Systems, Distributed, Database, and Multiprocessor Operating Systems, McGraw Hill paperback edition, 2017. | | |
| 3. | Vijay K. Garg, Elements of Distributed Computing, Wiley & Sons, 2014. | | |
| Recommended by Board of Studies | 05-03-2016 | | |
| Approved by Academic Council | No. 40 | Date | 18-03-2016 |

| Course code | Information Coding Theory | L | T | P | J | C |
|---|---|---|---|---|---|---|
| ITE3005 | | 3 | 0 | 0 | 4 | 4 |
| Pre-requisite | ITE2003 | Syllabus version | | | | |
| | | 1.00 | | | | |

**Course Objectives:**

- To understand various devices used in Digital Communication
- To understand the impact of interference on discrete time devices
- To learn the various coding and sampling techniques

**Expected Course Outcome:**

- Understand the design and construction of devices used in Communication Systems
- Address the challenges imposed in different types of Communication Systems
- Design and construct various digital communication systems and implement various sampling and coding techniques

**Student Learning Outcomes (SLO):** 1,2,6

| Module:1 | Information Theory | 6 hours | SLO: 1 |
|---|---|---|---|

Information – Entropy, Information rate, classification of codes, Kraft McMillan inequality, Source coding theorem, Shannon-Fano coding, Huffman coding, Extended Huffman coding - Joint and conditional entropies, Mutual information - Discrete memory less channels – BSC, BEC – Channel capacity, Shannon limit.

| Module:2 | Data Coding Techniques | 5 hours | SLO: 2 |
|---|---|---|---|

Pulse Code Modulation-Delta modulation-Adaptive Delta Modulation-Differential Pulse code modulation-Comparison of Different Pulse code Modulation Techniques.

| Module:3 | Textual Data Encoding Techniques | 4 hours | SLO: 1 |
|---|---|---|---|

ASCII-Unicode- Adaptive Huffman Coding, Arithmetic Coding, LZW algorithm.

| Module:4 | Audio and Speech Coding | 6 hours | SLO: 6 |
|---|---|---|---|

Audio: Perceptual coding, Masking techniques, Psychoacoustic model, MEG Audio layers I,II,III, Dolby AC3 - Speech: Coding Speech at lower pulse rate(ADPCM) Channel Vocoder, Linear Predictive Coding.

| Module:5 | Source Coding: Image and Video | 5 hours | SLO: 6 |
|---|---|---|---|

Image and Video Formats – GIF, TIFF, SIF, CIF, QCIF.

| Module:6 | Compression Techniques | 7 hours | SLO: 6 |
|---|---|---|---|

Image compression: READ, JPEG – Video Compression: Principles-I,B,P frames, Motion estimation, Motion compensation, H.261, MPEG standard.

| Module:7 | Error Control Coding: Block Codes | 9 hours | SLO: 1 |
|---|---|---|---|

Definitions and Principles: Hamming weight, Hamming distance, Minimum distance decoding - Single parity codes, Hamming codes, Repetition codes - Linear block codes, Cyclic codes - Syndrome calculation, Encoder and decoder - CRC -Convolutional codes – code tree, trellis, state diagram - Encoding – Decoding: Sequential search and Viterbi algorithm – Principle of Turbo coding.

| Module:8 | Contemporary issues: | 3 hours | |
|---|---|---|---|

| | | | |
|---|---|---|---|
| | **Total Lecture hours:** | **45 hours** | |

| | |
|---|---|
| **Text Book(s)** | |
| 1. | R Bose, Information Theory, Coding and Cryptography, TMH, 2008. |
| **Reference Books** | |
| 1. | Stefan M. Moser, Po-Ning Chen, A student's guide to Coding and Information Theory, Cambridge University Press, 2012. |
| 2. | K Sayood, Introduction to Data Compression,Third Edition, Elsevier, 2012. |
| 3. | S Gravano, Introduction to Error Control Codes, Oxford University Press, 2007 |
| 4. | Amitabha Bhattacharya, Digital Communication, TMH 2006, Fred Halsall, Multimedia Communications: Applications, Networks, Protocols and Standards, Pearson Education Asia, 2011 |

| | | | |
|---|---|---|---|
| Recommended by Board of Studies | 05-03-2016 | | |
| Approved by Academic Council | No. 40 | Date | 18-03-2016 |

| Course code | Cloud Computing and Virtualization | L | T | P | J | C |
|---|---|---|---|---|---|---|
| ITE3007 | | 3 | 0 | 0 | 4 | 4 |
| Pre-requisite | ITE2001 | Syllabus version | | | | |
| | | 1.00 | | | | |

**Course Objectives:**

- To learn recent computing paradigms
- To introduce the concept of Virtualization and secured environment
- To understand parallel and distributed programming

**Expected Course Outcome:**

- Design, implement and evaluate a cloud-based system, process, component, or program to meet desired needs.
- Use techniques, skills on cloud based tools.
- Develop program for parallel and distributed environment.

**Student Learning Outcomes (SLO):** 6,17

| Module:1 | Overview of Computing Paradigm | 5 hours | SLO: 6 |
|---|---|---|---|

Recent trends in Computing- Grid Computing, Cluster Computing, Distributed Computing, Utility Computing, Web services.

| Module:2 | Introduction to Cloud Computing | 6 hours | SLO: 6 |
|---|---|---|---|

Introduction to Cloud Computing- System Models for Distributed and Cloud Computing – NIST Cloud Computing Reference Architecture. Cloud Models:- Characteristics – Cloud Services – Cloud models (IaaS, PaaS, SaaS) – Public vs Private Cloud – Community Cloud – Hybrid Cloud.

| Module:3 | Basics of Virtualization | 6 hours | SLO: 17 |
|---|---|---|---|

Types of Virtualization - Implementation Levels of Virtualization - Virtualization Structures - Tools and Mechanisms - Virtualization of CPU, Memory, I/O Devices - Virtual Clusters and Resource management – Virtualization for Data-center Automation.

| Module:4 | Virtualization Techniques | 6 hours | SLO: 17 |
|---|---|---|---|

Storage Virtualization – System-level or Operating Virtualization – Control-Plane Virtualization– Virtual Machine Basics – Taxonomy of Virtual machines - Server Virtualization – Physical and Logical Partitioning - Types of Server Virtualization.

| Module:5 | Parallel and Distributed Programming Paradigms | 6 hours | SLO: 17 |
|---|---|---|---|

MapReduce, The map-Reduce model, Parallel efficiency of Map-Reduce, Relational operations using Map-Reduce, Enterprise batch processing using Map-Reduce, Cloud Software Environments -Google App Engine, Amazon AWS,Azure - Open Source tools.

| Module:6 | Cloud infrastructure | 6 hours | SLO: 6 |
|---|---|---|---|

Architectural Design of Compute and Storage Clouds – Layered Cloud Architecture Development – Design Challenges - Inter Cloud Resource Management – Resource Provisioning and Platform Deployment – Global Exchange of Cloud Resources.

| Module:7 | Security Overview | 7 hours | SLO: 17 |
|---|---|---|---|

Cloud Security Challenges and Risks – Software-as-a-Service Security – Security Governance – Risk Management – Security Monitoring – Security Architecture Design – Data Security – Application Security – Virtual Machine Security - Identity Management and Access Control – Autonomic Security.

| | | | |
|---|---|---|---|
| **Module:8** | **Contemporary issues** | **3 hours** | |
| | | | |
| | | | |
| | **Total Lecture hours:** | **45 hours** | |

| | |
|---|---|
| **Text Book(s)** | |
| 1. | Kai Hwang, Geoffrey C Fox, Jack G Dongarra, Distributed and Cloud Computing, From Parallel Processing to the Internet of Things, Morgan Kaufmann Publishers, 2012. |
| **Reference Books** | |
| 1. | Tim Mather, Subra Kumaraswamy, and Shahed Latif, Cloud Security and Privacy, Oreilly,2009 |
| 2. | Barrie Sosinsky, Cloud Computing Bible, Wiley-India, 2011. |
| 3. | Rajkumar Buyya, James Broberg, Andrzej M. Goscinski, Cloud Computing: Principles and Paradigms, Wiley, 2011. |
| 4. | Ronald L. Krutz, Russell Dean Vines, Cloud Security: A Comprehensive Guide to Secure Cloud Computing, Wiley-India, 2010. |
| 5. | John W.Rittinghouse and James F.Ransome, Cloud Computing: Implementation, Management, and Security, CRC Press, 2010. |
| 6. | Rajkumar Buyya, Chirstian Vecchiola, S.Thamarai Selvi, Mastering Cloud Computing, Tata McGraw Hill ,2013 |

| | | | |
|---|---|---|---|
| Recommended by Board of Studies | 05-03-2016 | | |
| Approved by Academic Council | No. 40 | Date | 18-03-2016 |

| Course code | Information Retrieval | L | T | P | J | C |
|---|---|---|---|---|---|---|
| ITE3008 | | 3 | 0 | 0 | 4 | 4 |
| Pre-requisite | ITE2006 | Syllabus version | | | | |
| | | 1.00 | | | | |

**Course Objectives:**

- To learn the classical techniques of Information Retrieval, and the additional techniques employed by Web search engines.
- To learn how to find relevant information and subsequently extract meaningful patterns out of it.
- To impart information on retrieval and data mining applications.
- To get an insight into practical algorithms of textual document indexing, relevance ranking, web usage mining, text analytics, as well as their performance evaluations.

**Expected Course Outcome:**

- Apply the common algorithms and techniques for information retrieval related to document indexing and query processing.
- Compare the quantitative evaluation methods for the information retrieval systems and text operation techniques.

**Student Learning Outcomes (SLO):** **2,14**

| | | | |
|---|---|---|---|
| **Module:1** | **Introduction** | **6 hours** | **SLO: 2** |

Basic Concepts – Retrieval Process – Modeling – Classic Information Retrieval – Set Theoretic, Algebraic and Probabilistic Models.

| | | | |
|---|---|---|---|
| **Module:2** | **Retrieval Techniques** | **6 hours** | **SLO: 2** |

Structured Text Retrieval Models –Retrieval Evaluation –Word Sense Disambiguation.

| | | | |
|---|---|---|---|
| **Module:3** | **Querying** | **6 hours** | **SLO: 14** |

Languages – Key Word based Querying – Pattern Matching – Structural Queries – Query Operations – User Relevance Feedback – Local and Global Analysis.

| | | | |
|---|---|---|---|
| **Module:4** | **Text Operations** | **6 hours** | **SLO: 14** |

Document Pre-processing – Clustering – Text Compression - Indexing and Searching – Inverted files – Boolean Queries – Sequential searching – Pattern matching.

| | | | |
|---|---|---|---|
| **Module:5** | **User Interface** | **6 hours** | **SLO: 14** |

User Interface and Visualization – Human Computer Interaction – Access Process – Starting Points – Query Specification - Context – User relevance Judgment – Interface for Search.

| | | | |
|---|---|---|---|
| **Module:6** | **Applications** | **6 hours** | **SLO: 2** |

Searching the Web – Challenges – Characterizing the Web – Search Engines – Browsing – Meta-searchers – Online IR systems – Online Public Access Catalogs.

| | | | |
|---|---|---|---|
| **Module:7** | **Digital Libraries** | **6 hours** | **SLO: 2** |

Introduction – Architectural Issues – Document Models, Representations and Access – Prototypes and Standards.

| | | | |
|---|---|---|---|
| **Module:8** | **Contemporary issues:** | **3 hours** | |
| | **Total Lecture hours:** | **45 hours** | |

| | | | |
|---|---|---|---|
| **Text Book(s)** | | | |
| 1. | Ricardo Baeza-Yate, Berthier Ribeiro-Neto, Modern Information Retrieval, Pearson Education Asia, 2012. | | |
| **Reference Books** | | | |
| 1. | G.G. Chowdhury, Introduction to Modern Information Retrieval, Second Edition, Neal- Schuman Publishers, 2010. | | |
| Recommended by Board of Studies | 05-03-2016 | | |
| Approved by Academic Council | No. 40 | Date | 18-03-2016 |

| Course code | Network Management Systems | L | T | P | J | C |
|---|---|---|---|---|---|---|
| ITE4002 | | 3 | 0 | 0 | 4 | 4 |
| Pre-requisite | ITE3001 | Syllabus version | | | | |
| | | 1.00 | | | | |

**Course Objectives:**

- To learn principles in monitoring and managing networks
- To understand the basic requirement of network design
- To understand various open source tools used for network management

**Expected Course Outcome:**

- Design, implement and evaluate a monitoring framework network-based system, process, component, or program to meet desired needs.
- Design a component to manage/monitor remote networks
- Use techniques, skills and modern Engineering tools.
- An ability to design and conduct experiments related to network tools, as well as to analyze and interpret data

**Student Learning Outcomes (SLO):** 2,7,17

| Module:1 | Network Management Architectures & Applications | 6 hours | SLO: 2 |
|---|---|---|---|

Management Standards and Models, Network Design Issues for the Project, Network Management Functions – Configuration, Configuration Management & Auto-discovery, Configuration Database & Reports, Abstract Syntax Notation One (ASN.1)

| Module:2 | Network management and functions | 6 hours | SLO: 2 |
|---|---|---|---|

Introduction- Basic Concepts and task: functional areas, SNMP, Client Pull & Server Push, Ports & UDP, Parts of SNMP, Nodes, SNMP Agents, Proxy & Gateway Agents, Basic Operations, Languages of SNMP, SNMP Data Types, Managed "Objects" & MIBs, Commercial SNMP Applications, SNMP & Windows services

| Module:3 | Network Management Functions – Fault | 6 hours | SLO: 7 |
|---|---|---|---|

Fault Management, Fault Identification and Isolation, Event Correlation Techniques, Simple Network Management Protocol - SNMP v2, Protocol Specification, Version 2 MIB Enhancements, MIB-II, Case Diagrams

| Module:4 | Simple Network Management Protocol - SNMP v3 | 6 hours | SLO: 2 |
|---|---|---|---|

Version 3 Protocol & MIB, Simple Network Management Protocol - SNMP v3, User Based Security Model, View Based Access Model, Network Management Functions - Accounting & Performance, Accounting Management, Performance Management, Network Usage, Metrics and Quotas

| Module:5 | Network Management Architectures & Applications | 6 hours | SLO: 7 |
|---|---|---|---|

Management Standards and Models, NM Standards - International standard (ISO/OSI), Internet model, TMN Architecture, Organization Model, 2 &3 tier models, Information Model, Communication Model

| Module:6 | Remote Network Monitoring RMON 1 | 7 hours | SLO: 7 |
|---|---|---|---|

Statistics Collection, Alarms and Filters, Remote Network Monitoring RMON 2, Monitoring Network Protocol Traffic, Application-Layer Visibility

| | | | |
|---|---|---|---|
| **Module:7** | **Management Open Source Tools** | **5 hours** | **SLO: 17** |
| OpenNMS, NMIS, op5, Nagios | | | |
| | | | |
| **Module:8** | **Contemporary issues** | **3 hours** | |
| | | | |
| | | | |
| | **Total Lecture hours:** | **45 hours** | |

| | |
|---|---|
| **Text Book(s)** | |
| 1. | Verma, Dinesh Chandra, Principles of Computer Systems and Network Management, Springer, 2010 |
| **Reference Books** | |
| 1. | Mani Subramanian, Network Management Principles and practice, Addison Wesley New York, 2010. |
| 2. | Ghislain Hachey, Instant OpenNMS Starter, packt, June 2013 |

| | | | |
|---|---|---|---|
| Recommended by Board of Studies | 05-03-2016 | | |
| Approved by Academic Council | No. 40 | Date | 18-03-2016 |

| Course code | Internet of Things | L | T | P | J | C |
|---|---|---|---|---|---|---|
| ITE4003 | | 3 | 0 | 0 | 4 | 4 |
| Pre-requisite | ITE3001 | Syllabus version | | | | |
| | | 1.00 | | | | |

**Course Objectives:**

- To understand the application areas of IOT
- To analyse the advancements of Internet in mobile Device, Cloud & Sensor Networks.
- To understand building blocks of Internet of Things and characteristics

**Expected Course Outcome:**

- Identify the main components composing the Internet of Things
- Critically evaluate ethical and potential security issues related to the Internet of Things
- Develop tools and technologies (e.g., RFID/NFC, sensors, embedded systems, and smartphones) to create new Internet of Things solutions.

**Student Learning Outcomes (SLO):** 2,7,18

| Module:1 | Introduction to Internet of Things | 6 hours | SLO: 2 |
|---|---|---|---|

Definition & Characteristics of IoT, Physical Design of IoT, Things in IoT, IoT Protocols, Logical Design of IoT, IoT Communication Models, IoT Communication APIs, IoT Enabling Technologies.

| Module:2 | IoT Enabling Technologies | 6 hours | SLO: 2 |
|---|---|---|---|

Wireless Sensor Networks, Cloud Computing, Big Data Analytics, Communication Protocols, Embedded Systems, Embedded Systems, IoT Level-1, IoT Level-2, IoT Level-3, IoT Level-4, IoT Level-5.

| Module:3 | Domain Specific IoTs I | 6 hours | SLO: 18 |
|---|---|---|---|

Home Automation, Smart Lighting, Smart Appliances, Intrusion Detection, Smoke/Gas Detectors, Cities- Smart Parking, Smart Lighting, Structural Health Monitoring, Surveillance, Environment- Weather Monitoring, Air Pollution Monitoring, Noise Pollution Monitoring, Forest Fire Detection, River Floods Detection.

| Module:4 | Domain Specific IoTs II | 7 hours | SLO: 18 |
|---|---|---|---|

Energy- Smart Grids, Renewable Energy Systems, Prognostics, Retail- Inventory Management, Smart Payments, Smart Vending Machines, Logistics- Route Generation & Scheduling, Shipment Monitoring, Remote Vehicle Diagnostics, Agriculture- Smart Irrigation, Green House Control, Industry- Machine Diagnosis & Prognosis, Indoor Air Quality Monitoring, Health & Lifestyle, Wearable Electronics.

| Module:5 | IoT and M2M | 6 hours | SLO: 7 |
|---|---|---|---|

Introduction to M2M , Difference between IoT and M2M, SDN and NFV for IoT, Software Defined Networking, Network Function Virtualization , IoT System Management with NETCONF-YANG, Need for IoT Systems Management , Network Operator Requirements , NETCONF , YANG.

| Module:6 | IoT Platforms Design Methodology | 6 hours | SLO: 7 |
|---|---|---|---|

Process Specification, Domain Model Specification , Information Model Specification , Service Specifications , IoT Level Specification , Functional View Specification , Operational View Specification , Device & Component Integration , Case Study on IoT System for Weather Monitoring, IoT Physical Devices & Endpoints , Basic building blocks of an IoT Device, Exemplary Device: Raspberry Pi , pcDuino, BeagleBone Black , Cubieboard.

| | | | |
|---|---|---|---|
| **Module:7** | **IoT Physical Servers & Cloud Offerings** | **6 hours** | **SLO: 2** |
| Introduction to Cloud Storage Models & Communication APIs, WAMP - AutoBahn for IoT, Xively Cloud for IoT, Django Architecture, Starting Development with Django, Amazon Web Services for IoT, Amazon EC2, Amazon AutoScaling, Amazon S3, Amazon RDS, Amazon DynamoDB, Amazon Kinesis, Amazon SQS, Amazon EMR, SkyNet IoT Messaging Platform. | | | |
| **Module:8** | **Contemporary issues** | **2 hours** | |
| | **Total Lecture hours:** | **45 hours** | |

**Text Book(s)**

| | |
|---|---|
| 1. | Vijay Madisetti and Arshdeep Bahga, Internet of Things: A Hands-On Approach, VPT edition1, 2014. |

**Reference Books**

| | |
|---|---|
| 1. | Jonathan Follett, Designing for Emerging - UX for Genomics, Robotics, and the Internet of Things Technologies, O'Reilly, 2014. |

| | | | |
|---|---|---|---|
| Recommended by Board of Studies | 05-03-2016 | | |
| Approved by Academic Council | No. 40 | Date | 18-03-2016 |

| Course code | Wireless Mobile Networking | L | T | P | J | C |
|---|---|---|---|---|---|---|
| ITE4004 | | 3 | 0 | 0 | 4 | 4 |
| Pre-requisite | ITE3001 | Syllabus version | | | | |
| | | 1.00 | | | | |

**Course Objectives:**

- To learn about different types of wireless and mobile systems.
- To understand the various layers in wireless network.
- To have in-depth knowledge in routing protocols

**Expected Course Outcome:**

- Design, implement and evaluate a wireless network, component, or program to meet desired needs.
- Choose different MAC, routing protocols for the desired need.
- Use techniques, skills and simulation tools.

**Student Learning Outcomes (SLO):** 6,17

| | | | |
|---|---|---|---|
| **Module:1** | **Introduction** | **6 hours** | **SLO: 6** |
| Fundamentals of wireless and mobile systems - IEEE 802.11 - Wireless LAN's, PAN's. | | | |
| **Module:2** | **Wireless WAN's and MAN's** | **6 hours** | **SLO: 6** |
| Cellular concept and architecture, UMTS, 2G/3G Versus LTE, Next Generation Mobile Networks.–Wireless Internet. | | | |
| **Module:3** | **Ad hoc wireless networks** | **6 hours** | **SLO: 17** |
| Sensor networks – Challenges and Constraints – Node architecture – Layered and cluster architecture - Mesh networks. | | | |
| **Module:4** | **Mac Protocols** | **6 hours** | **SLO: 17** |
| Issues in designing MAC Protocol and goals –Classification –Contention based- Contention based with reservation- Contention based with scheduling. | | | |
| **Module:5** | **Routing Protocols** | **6 hours** | **SLO: 17** |
| Introduction - Issues of routing protocol - Classification - DSDV, WRP, CSGR, DSR, AODV, TORA, ZRP, OLSR, HSRP, PAR, Secure routing in ad hoc networks. | | | |
| **Module:6** | **Transport Layer Protocols** | **6 hours** | **SLO: 17** |
| Issues in designing transport layer protocols for ad hoc networks— Classification – TCP over ad hoc networks. | | | |
| **Module:7** | **QoS for Wireless Networks** | **6 hours** | **SLO: 6** |
| Issues and challenges in providing the QoS in wireless networks –Energy Management. | | | |
| **Module:8** | **Contemporary issues:** | **3 hours** | |
| | **Total Lecture hours:** | **45 hours** | |

**Text Book**

| | |
|---|---|
| 1. | C. Siva Ram Murthy, B. S. Manoj, Ad Hoc Wireless Networks – Architecture and Protocols, Pearson Education, 2010. |

| **Reference Books** | | | | |
|---|---|---|---|---|
| 1. | Asoke K. Talukder, Roopa R.Yavagal, Mobile Computing-Technology, Applications and Service Creation, Tata McGraw Hill, 2010 | | | |
| 2. | Waltenegus Dargie, Christian Poellabauer, Fundamentals of wireless sensor Networks - theory and practice, John Wiley & Sons, 2010. | | | |
| 3. | Ian F. Akyildiz, Mehmet Can Vuran, Wireless Sensor Networks, John Wiley & Sons, 2010. | | | |
| Recommended by Board of Studies | | 05-03-2016 | | |
| Approved by Academic Council | | No. 40 | Date | 18-03-2016 |

| Course code | Network Programming, Protocols and Standards | L | T | P | J | C |
|---|---|---|---|---|---|---|
| ITE4010 | | 3 | 0 | 0 | 4 | 4 |

| Pre-requisite | ITE3001 | Syllabus version |
|---|---|---|
| | | 1.00 |

**Course Objectives:**

- To learn the foundation of various techniques for Network Programming.
- To understand the protocols of TCP/IP protocol suite
- To get an insight into network standards

**Expected Course Outcome:**

- To implement several network operations including socket connection.
- To analyze how protocols work in different layers

**Student Learning Outcomes (SLO):** 2,7,17

| | | | |
|---|---|---|---|
| **Module:1** | **Network Layer Protocols** | **6 hours** | **SLO: 2** |
| IPv4 – IPv6 - RIP – OSPF – BGP – Multicasting | | | |
| **Module:2** | **Basics of Network Programming** | **5 hours** | **SLO: 2** |
| Internet – Client Server Model – Streams – Internet Address | | | |
| **Module:3** | **URL and HTTP** | **6 hours** | **SLO: 17** |
| URL's and URI's - HTTP Methods – URL Connections | | | |
| **Module:4** | **Transport Layer Protocols** | **5 hours** | **SLO: 17** |
| Functions, Services and Header Formats of TCP and UDP | | | |
| **Module:5** | **Socket Programming for Clients and Server** | **10 hours** | **SLO: 2** |
| Using Sockets – Constructing and connecting sockets – Getting information about a socket – Setting socket options - Using Server sockets – Constructing Server sockets – Server socket options | | | |
| **Module:6** | **UDP Sockets** | **5 hours** | **SLO: 2** |
| UDP Protocol-UDP clients and Servers- Datagram Packet Class – Datagram Socket class – Socket options | | | |
| **Module:7** | **Network Standards** | **5 hours** | **SLO: 7** |
| Wired Standards – Wireless Standards | | | |
| **Module:8** | **Contemporary issues:** | **3 hours** | |
| | | | |
| | | | |
| | **Total Lecture hours:** | **45 hours** | |

**Text Book(s)**

| | | | | |
|---|---|---|---|---|
| 1. | Elliotte Rusty Harold, Java Network Programming, O'Reilly Media, 2013 | | | |
| **Reference Books** | | | | |
| 1. | Behrouz A. Forouzan, TCP/IP Protocol Suite, McGrawHill Publication, 2011 | | | |
| 2. | W. Richard Stevens, Unix Network Programming-The Sockets Networking API, Pearson, 2013 | | | |
| | | | Total Laboratory Hours | 30 hours |
| Recommended by Board of Studies | 05-03-2016 | | | |
| Approved by Academic Council | No. 40 | Date | 18-03-2016 | |

| Course Code | Applied Numerical Methods | L | T | P | J | C |
|---|---|---|---|---|---|---|
| MAT-3005 | | 3 | 2 | 0 | 0 | 4 |
| Pre-requisite | MAT2002 | Syllabus Version | | | | |
| | | 1.0 | | | | |

**Course Objectives:**

- The aim of this course is to cover certain basic, important computer oriented numerical methods for analyzing problems that arise in engineering and physical sciences. The students are expected to use MATLAB as the primary computer language to obtain solutions to a few assigned problems.
- On completion of this course, the students are expected to appreciate the power of numerical methods and use them to analyze the problems connected with data analysis, and solution of ordinary and partial differential equations that arise in their respective engineering courses.

**Expected Course Outcome**

At the end of this course the students are expected to learn

- the difference between exact solution and approximate solution.
- the numerical techniques (algorithms) to find the solution (approximate) algebraic equations and system of equations.
- how to fit the data using interpolation technique and spline methods.
- how to find the numerical solution of ordinary differential equations.
- the solution of Heat and Wave equation numerically.

| Student Learning Outcomes (SLO): | 1,2,7 |
|---|---|

| Module:1 | Algebraic and Transcendental Equations | 5 hours | SLO: 1,2 |
|---|---|---|---|

General iterative method- rates of convergence- Secant method - Newton – Raphson method-System of non-linear equations by Newton's method.

| Module:2 | System of Linear Equations and Eigen Value Problems | 6 hours | SLO: 2,9 |
|---|---|---|---|

Gauss –Seidel iteration method. Convergence analysis of iterative methods-LU Decomposition -Tri diagonal system of equations-Thomas algorithm- Eigen values of a matrix by Power and Jacobi methods.

| Module:3 | Interpolation | 6 hours | SLO: 2,7 |
|---|---|---|---|

Finite difference operators- Newton's forward-Newton's Backward- Central differences-Stirling's interpolation - Lagrange's interpolation - Inverse Interpolation-Newton's divided difference-Interpolation with cubic splines.

| | | | |
|---|---|---|---|
| **Module:4** | **Numerical Differentiation and Integration** | **6 hours** | **SLO:** 1,2 |
| Numerical differentiation with interpolation polynomials-maxima and minima for tabulated values-Trapezoidal rule, Simpsons 1/3rd and 3/8th rules. –Romberg's method. Two and Three point Gaussian quadrature formula. | | | |
| | | | |
| **Module:5** | **Numerical Solution of Ordinary Differential Equations** | **8 hours** | **SLO: 1**,7 |
| First and second order differential equations - Fourth order Runge – Kutta method. Adams-Bashforth-Moulton predictor-corrector methods. Finite difference solution for the second order ordinary differential equations. | | | |
| | | | |
| **Module:6** | **Numerical Solution of Partial Differential Equations** | **6 hours** | **SLO:** 2, 7 |
| Classification of second order linear partial differential equations-Laplace equation –Gauss-Seidal method-One dimensional heat equation- Schmidt explicit method-Crank-Nicolson implicit method.-One dimensional wave equation–Explicit method. | | | |
| | | | |
| **Module:7** | **Vibrational Methods** | **6 hours** | **SLO: 1**,7 |
| Introduction to calculus of variations -Definition of functional - Extremals of functional of a single dependent variable and its first derivative-Functional involving higher order derivatives- Functional involving several variables Isoperimetric problems-Galerkins method. | | | |
| | | | |
| **Module:8** | **Contemporary Issues** | **2 hours** | |
| Industry Expert Lecture | | | |
| | **Total Lecture hours:** | **45 hours** | |
| **Tutorial** | • A minimum of 10 problems to be worked out by students in every Tutorial Class.<br>• Another 5 problems per Tutorial Class to be given for practise. | **30 hours** | **SLO: 1,2,7** |
| **Text Book(s)** | | | |
| 1. M. K. Jain, S. R. K. Iyengar and R. K. Jain, Numerical Methods for Scientific and Engineering, New Age International Ltd., 6th Edition, 2012.<br>2. C. F. Gerald and P.V. Wheatley Applied Numerical Analysis, Addition-Wesley, 7th Edition, 2004. | | | |
| **Reference Books** | | | |
| 1. S.S. Sastry, Introductory Methods of Numerical Analysis, PHI Pvt. Ltd., 5th Edition, New Delhi, 2009.<br>2. W.Y. Yang, W. Cao, T.S. Chung and J. Morris, Applied Numerical Methods Using MATLAB, | | | |

| | |
|---|---|
| | Wiley India Edn., 2007.<br>3. Steven C. Chapra and Ra P. Canale, Numerical Methods for Engineers with Programming and Software Applications, 7th Edition, Tata McGraw Hill, 2014.<br>4. R.L. Burden and J. D. Faires, Numerical Analysis, 4th Edition, Brooks Cole, 2012. |

| **Mode of Evaluation** | | | |
|---|---|---|---|
| Digital Assignments (Solutions by using soft skills), Continuous Assessment Tests, Final Assessment Test | | | |
| Recommended by Board of Studies | 05-03-2016 | | |
| Approved by Academic Council | No.40 | Date | 18-03-2016 |

## STUDENT LEARNING OUTCOMES (SLO)

1. Having an ability to apply mathematics and science in engineering applications
2. Having a clear understanding of the subject related concepts and of contemporary issues
3. Having an ability to be socially intelligent with good SIQ (Social Intelligence Quotient) and EQ (Emotional Quotient)
4. Having Sense-Making Skills of creating unique insights in what is being seen or observed (Higher level thinking skills which cannot be codified)
5. Having design thinking capability
6. Having an ability to design a component or a product applying all the relevant standards and with realistic constraints
7. Having computational thinking (Ability to translate vast data in to abstract concepts and to understand database reasoning)
8. Having Virtual Collaborating ability
9. Having problem solving ability- solving social issues and engineering problems
10. Having a clear understanding of professional and ethical responsibility
11. Having interest in lifelong learning
12. Having adaptive thinking and adaptability
13. Having cross cultural competency exhibited by working in teams
14. Having an ability to design and conduct experiments, as well as to analyze and interpret data
15. Having an ability to use the social media effectively for productive use
16. Having a good working knowledge of communicating in English
17. Having an ability to use techniques, skills and modern engineering tools necessary for engineering practice
18. Having critical thinking and innovative skills
19. Having a good cognitive load management skills
20. Having a good digital footprint.

# B.TECH (IT) - PROGRAMME SLO MAPPING

| TYPE | COURSE CODE | COURSE TITLE | STUDENT LEARNING OUTCOMES | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
| UNIVERSITY CORE | CHY1002 | Environmental Sciences | * | * | | | | | | | | | * | | | | | | | | | |
| | CHY1701 | Engineering Chemistry | * | * | | | | | | | | | | | | * | | | | | | |
| | CSE1001 | Problem Solving and Programming | * | | | * | | * | | | | | | | | | | | | | | |
| | CSE1002 | Problem Solving and Object Oriented Programming | * | | | | | | | | * | | | | | | | | * | | | |
| | ENG1011 | English for Engineers | | | * | | | | | | | * | * | * | | | | * | | | | |
| | HUM1021 | Ethics and Values | * | | * | * | | | | | | | | | | | | | | | | |
| | ITE3099 | Industrial Internship | | | | | | | | | | | | * | | | | | * | | | * |
| | ITE3999 | Technical Answers for Real World Problems (TARP) | | | | | * | * | | | | | | | | | | | * | | | |
| | ITE4098 | Comprehensive Examination | | * | | | | | | | | | | | | | | | | | | |
| | ITE4099 | Capstone Project | | | | | * | * | | | | | | | | | | | | | | * |
| | MAT1011 | Calculus for Engineers | * | * | | | | | | | * | | | | | | | | | | | |
| | MAT2001 | Statistics for Engineers | * | * | | | | | * | | | | | | | | | | | | | |
| | MGT1022 | Lean Start-up Management | | * | | * | | | | | | | | | | | | | | | * | |
| | PHY1701 | Engineering Physics | * | * | | * | | | | | | | | | | | | | | | | |
| | PHY1999 | Introduction to Innovative Projects | | * | | * | * | | | | * | | * | * | | | | * | | | | |
| | EXC4097 | Co-Extra Curricular Basket | | | | | | | | | | * | | | * | | | | | | | |
| | FLC4097 | Foreign Language Course Basket | | | | | | | | | | | * | * | | | | * | | * | | |
| | STS4097 | Soft Skills | | | | | | | | * | * | * | * | * | * | | | | * | * | | |
| PROGRAMME CORE | EEE1001 | Basic Electrical and Electronics Engineering | * | * | | | | | | | * | | | | | | | | | | | |
| | ITE1001 | Digital Logic and Microprocessor | | | | | | * | | | | | | | | * | | | | | | |
| | ITE1002 | Web Technologies | | | | | | * | * | | | | | | | | | | | | | |
| | ITE1003 | Database Management Systems | | * | | | * | * | | | | | | | | | | | | | | |

| | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | ITE1004 | Data Structures and Algorithms | * | * | | | | | | | | | | | | | | | | | | |
| | ITE1005 | Software Engineering-Principles and Practices | | * | | | | | | | | * | | | | | | | * | | | |
| | ITE1006 | Theory of Computation | * | | | | * | | | | | | | | | | | | | | | |
| | ITE2001 | Computer Architecture and Organization | * | * | | * | | | | | | | | | | | | | | | | |
| | ITE2002 | Operating Systems | | * | | | * | | | | | | | | | | | | * | | | |
| | ITE3001 | Data Communication and Computer Networks | * | * | | | * | | | | | | | | | | | | | | | |
| | ITE4001 | Network and Information Security | * | * | | | | | | | | | | | | | | | * | | | |
| | MAT1014 | Discrete Mathematics and Graph Theory | * | * | | | | | * | | | | | | | | | | | | | |
| | MAT2002 | Applications of Differential and Difference Equations | * | * | | | | | | | * | | | | | | | | | | | |
| | MAT3004 | Applied Linear Algebra | * | * | | | | | * | | | | | | | | | | | | | |
| PROGRAMME ELECTIVE | ITE1007 | Object Oriented Analysis and Design | | * | | | * | * | | | | | | | | | | | | | | |
| | ITE1008 | Open Source programming | | * | | | * | | | | | | | | | | | | | | | |
| | ITE1010 | Digital Image Processing | * | | | | | | | | | | | | * | | | | | | | |
| | ITE1011 | Computer Graphics | * | | | | | | | | | | | | * | | | | | | | |
| | ITE1014 | Human Computer Interaction | | * | | | | * | | | | | | | | | | | | | | |
| | ITE1015 | Soft Computing | * | * | | | | | * | | | | | | | | | | | | | |
| | ITE1016 | Mobile Application Development | | | | | * | * | | | | | | * | | | | | | | | |
| | ITE1017 | Transformation Techniques | * | * | | | | | | | * | | | | | | | | | | | |
| | ITE2003 | Principles and Practices of Communication System | | * | | | | * | | | | | | | * | | | | | | | |
| | ITE2004 | Software Testing | | * | | | | | * | | | | | | | | | | | | | |
| | ITE2005 | Advanced Java Programming | | * | | | * | | | | | | | | | | | | * | | | |
| | ITE2006 | Data Mining Techniques | * | * | | | | | | | | | | | * | | | | | | | |
| | ITE2009 | Storage Technologies | | * | | | * | | | | | | | * | | | | | | | | |

| | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | ITE2010 | Artificial Intelligence | * | * | | | | | | | * | | | | | | | | | | | |
| | ITE2011 | Machine Learning | | * | | * | | | | | | | | | | | | | | * | | |
| | ITE2012 | .Net Programming | * | * | | | * | | | | | | | | | | | | | | | |
| | ITE2013 | Big Data Analytics | | | | | | | * | | | | | | | * | | | | | | |
| | ITE2014 | Software Project Management | | * | | * | | | | | | * | | | | | | | | | | |
| | ITE2015 | Information System Audit | | * | | | | | | | | | | | | | | | | | | |
| | ITE3002 | Embedded Systems | | * | | * | | | | | | | | | | | | | * | | | |
| | ITE3003 | Parallel Processing | * | * | | | | | | | * | | | | | | | | | | | |
| | ITE3004 | Distributed Systems | | * | | | | | * | | | | | | | | | | * | | | |
| | ITE3005 | Information Coding Theory | * | * | | | | * | | | | | | | | | | | | | | |
| | ITE3007 | Cloud Computing and Virtualization | | | | | | * | | | | | | | | | | | * | | | |
| | ITE3008 | Information Retrieval | | * | | | | | | | | | | | | * | | | | | | |
| | ITE4002 | Network Management Systems | | * | | | | | * | | | | | | | | | | * | | | |
| | ITE4003 | Internet of Things | | * | | | | | * | | | | | | | | | | | * | | |
| | ITE4004 | Wireless Mobile Networking | | | | | | * | | | | | | | | | | | * | | | |
| | ITE4010 | Network Programming, Protocols and Standards | | * | | | | | * | | | | | | | | | | * | | | |
| | MAT3005 | Applied Numerical Methods | * | * | | | | | * | | | | | | | | | | | | | |