University of Engineering & Management, Kolkata

Syllabus

B.Tech

In

Computer Science and Engineering

List of Program Outcomes (Pos) are given below.

PO NUMBER	SUMMARY	DESCRIPTION
PO1	Engineering knowledge	Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of the complex engineering problems.
PO2	Problem analysis	Identify, formulate, research literature, and analyze complex engineering problems reaching substantial conclusion using first principal of mathematics, natural science and engineering sciences.
PO3	Design /development of solutions	Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4	Conduct investigations of complex problems	Use research-based knowledge and research methods including designs of experiments analysis and interpretation of data and synthesis of information to provide valid conclusions.
PO5	Modern tool usage	Create, select, and apply appropriate techniques, resources and modern engineering and IT tools including prediction and modeling to complex engineering values activities with an understanding of the limitation.
PO6	The engineer and society	Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO7	Environment and sustainability	Understand the impact of professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO8	Ethics	Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9	Individual and team work	Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
P010	Communication	Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
P011	Project management and finance	Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team,
P012	Life-long learning	Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

List of Program Specific Outcomes (PSOs)

PSO Number	Description
PSO 1	Ability to understand the principles and development methodologies of computer systems. Students can assess the hardware of computer systems and possess professional skills and knowledge of software design process.
PSO 2	Ability to apply mathematical methodologies to solve computation task, model real world problem using appropriate data structure and suitable algorithm.
PSO 3	Ability to use knowledge in various domains to identify research gaps and hence to provide solution to new ideas and innovations.

List of Program Educational Objectives (PEOs)

PEO 01: High Quality Engineering Design and Development Work:

Graduates of the program will engage in the effective practice of computer science and engineering to identify and solve important problems in a diverse range of application areas.

PEO 02: Real Life Problem Solving:

To educate students with proficiency in core areas of Computer science & Engineering and related engineering so as to comprehend engineering trade-offs, analyze, design, and synthesize data and technical concepts to create novel products and solutions for the real life problems.

PEO 03: Leadership:

Graduates of the program will engage in successful careers in industry, academia and attain positions of importance where they have impact on their business, profession and community.

PEO 04: Lifelong Learning:

Graduates of the program will adapt to contemporary technologies, tools and methodologies to remain at the frontier of computer science and engineering practice with the ability to respond to the need of a challenging environment.

Recommended Professional Elective Courses			
SL. NO.	**SEMESTER**	**AI & Machine Learning track**	**IoT, Cyber security & Block chain track**
PEC-1	Sem – 5	Neural Networks and Deep Learning	Cyber security
PEC-2	Sem – 6	Soft Computing	Human Computer Interaction
PEC-3	Sem – 6	Data Analytics	Blockchain Technology
PEC-4	Sem – 7	Speech and Natural Language Processing	Embedded Systems
PEC-5	Sem – 7	Image Processing	Digital Forensics
PEC-6	Sem – 8	Quantum Computing	Cyber Law, IPR & Ethics

Recommended Open Elective Courses			
SL. NO.	**SEMESTER**	**AI & Machine Learning track**	**IoT, Cyber security & Block chain track**
OEC-1	Sem – 6	Human Resource Development and Organizational Behavior	Human Resource Development and Organizational Behavior
OEC-2	Sem - 7	Cyber Security	Data Analytics
OEC-3	Sem - 7	Cyber Law, IPR & Ethics	Neural Networks and Deep Learning
OEC-4	Sem - 8	Digital Forensics	Quantum Computing

Semester : 1								
Sr. No	**Type of Course**	**Course Code**	**Course Title**	**Hours per week**				**Credits**
				Lecture	**Tutorial**	**Practical**	**Sessional**	
1	Basic Science Course	BSC101	Physics	4	0	0	0	**4**
2	Basic Science Course	BSC191	Physics Laboratory	0	0	2	0	**1**
3	Basic Science Course	BSC103	Mathematics & Statistics – I	3	0	0	0	**3**
4	Engineering Science Course	ESC101	Basic Electrical Engineering	2	0	0	0	**2**
5	Engineering Science Course	ESC191	Basic Electrical Engineering Laboratory	0	0	2	0	**1**
6	Humanities and social sciences including Management Courses	HSMC102	Essential Studies for Professionals – I	2	0	0	0	**2**
7	Engineering Science Course	ESC193	Workshop & Manufacturing Practices -I	0	0	2	0	**1**
8	Humanities and social sciences including Management Courses	HSMC182	Skill Development for Professionals – I	0	0	0	2	**1**
9	Engineering Science Course	ESC181	Computer Programming for Problem Solving Using Python & C-I	1	0	0	3	**2**
10	Humanities and social sciences including Management Courses	HSMC101	English Communication and Public Speaking Skills-I	2	0	0	0	**2**
11	Humanities and social sciences including Management Courses	HSMC191	English Communication and Public Speaking Skills Laboratory -I	0	0	2	0	**1**
12	Humanities and social sciences including Management Courses	HSMC183	Design Thinking & Innovation- I	0	0	0	1	**0.5**
13	Humanities and social sciences including Management Courses	HSMC181	Economics, Finance and Entrepreneurship Skills – I	0	0	0	2	**1**
14	Mandatory Additional Requirements	MC181	Mandatory Additional Requirements (MAR)	0	0	0	0	**0.5**
15	MOOCs (Mandatory for Honours)	MOOC 1	Massive Open Online Course (Mandatory for B.Tech(Honours))	0	0	0	0	**2**
Total Credit Points of Semester [for B.Tech]				**14**	**0**	**8**	**8**	**22**
Total Credit Points of Semester [for B.Tech (Hons.)]								**24**

Semester : 2								
Sr. No	**Type of Course**	**Course Code**	**Course Title**	**Hours per week**				**Credits**
				Lecture	**Tutorial**	**Practical**	**Sessional**	
1	Basic Science Course	BSC202	Chemistry	4	0	0	0	**4**
2	Basic Science Course	BSC292	Chemistry Laboratory	0	0	2	0	**1**
3	Basic Science Course	BSC203	Mathematics & Statistics – II	3	0	0	0	**3**
4	Engineering Science Course	ESC201	Basic Electronics Engineering	2	0	0	0	**2**
5	Engineering Science Course	ESC291	Basic Electronics Engineering Laboratory	0	0	2	0	**1**
6	Engineering Science Course	ESC203	Programming for Problem Solving	1	0	0	0	**2**
7	Humanities and social sciences including Management Courses	HSMC201	English Communication and Public Speaking Skills-II	2	0	0	0	**2**
8	Humanities and social sciences including Management Courses	HSMC291	English Communication and Public Speaking Skills-II Laboratory	0	0	2	0	**1**
9	Engineering Science Course	ESC204	Engineering Mechanics	3	0	0	0	**3**
10	Humanities and social sciences including Management Courses	HSMC202	Essential Studies for Professionals – II	2	0	0	0	**2**
11	Engineering Science Course	ESC293	Programming for Problem Solving Laboratory	0	0	0	3	**1**
12	Engineering Science Course	ESC294	Engineering Drawing, 3D Design Laboratory	0	0	2	0	**1**
13	Humanities and social sciences including Management Courses	HSMC282	Skill Development for Professionals – II	0	0	0	2	**1**
14	Humanities and social sciences including Management Courses	HSMC281	Foreign Language	1	0	0	0	**0.5**
15	Humanities and social sciences including Management Courses	HSMC283	Physical Education	1	0	0	0	**0.5**
16	MOOCs (Mandatory for Honours)	MOOC202	Design Thinking & Innovation- II	0	0	0	1	**1**
17	MOOCs (Mandatory for Honours)	MOOC201	Economics, Finance and Entrepreneurship Skills – II	0	0	0	2	**1.5**
Total Credit Points of Semester [for B.Tech]				**19**	**0**	**8**	**8**	**25**
Total Credit Points of Semester [for B.Tech (Hons.)]								**27.5**

Semester : 3							
Sr. No	**Type of Course**	**Course Code**	**Course Title**	**Hours per week**			
				Lecture	**Tutorial**	**Practical**	**Credits**
1	Engineering Science Course	ESC301	Analog Electronic Circuits	3	0	0	**3**
2	Engineering Science Course	ESC391	Analog Electronic Circuits Laboratory	0	0	4	**2**
3	Professional Core Courses	PCC-CS301	Data Structure & Algorithms	3	0	0	**3**
4	Professional Core Courses	PCC-CS391	Data Structure & Algorithms Laboratory	0	0	4	**2**
5	Engineering Science Course	ESC302	Digital Electronics	3	0	0	**3**
6	Engineering Science Course	ESC392	Digital Electronics Laboratory	0	0	4	**2**
7	Professional Core Courses	PCC-CS302	IT Workshop (Sci Lab/MATLAB/Python/ R)	1	0	0	**1**
8	Professional Core Courses	PCC-CS392	IT Workshop Practical (Sci Lab/MATLAB/Python/ R)	0	0	4	**2**
9	Basic Science Course	BSC301	Mathematics-III (Differential Calculus, Probability, Statistics)	2	0	0	**2**
10	Humanities and social sciences including Management Courses	HSMC301	Humanities – I (Technical Report Writing using Latex)	3	0	0	**3**
11	Humanities and social sciences including Management Courses	HSMC302	Universal Human Values – III	3	0	0	**3**
12	Mandatory Additional Requirements (MAR)	MC381	Mandatory Additional Requirements (MAR)	0	0	0	**0**
13	Project	PROJ-CS301	Innovative Project - I	0	0	0	**1**
14	MOOCs (Mandatory for Honours)	MOOC 3	Massive Open Online Course (Mandatory for B.Tech(Honours))	0	0	0	**1**
Total Credit Points of Semester [for B.Tech]				**18**	**0**	**16**	**27**
Total Credit Points of Semester [for B.Tech (Hons.)]							**28**

Semester : 4							
Sr. No	**Type of Course**	**Course Code**	**Course Title**	**Hours per week**			
				Lecture	**Tutorial**	**Practical**	**Credits**
1	Professional Core Courses	PCC-CS401	Discrete Mathematics	3	1	0	**4**
2	Professional Core Courses	PCC-CS402	Computer Organization & Architecture	3	0	0	**3**
3	Professional Core Courses	PCC-CS492	Computer Organization & Architecture Laboratory	0	0	4	**2**
4	Professional Core Courses	PCC-CS403	Operating Systems	3	0	0	**3**
5	Professional Core Courses	PCC-CS493	Operating Systems Laboratory	0	0	4	**2**
6	Professional Core Courses	PCC-CS404	Design & Analysis of Algorithms	3	0	0	**3**
7	Professional Core Courses	PCC-CS494	Design & Analysis of Algorithms Laboratory	0	0	4	**2**
8	Professional Core Course	PCC-CS405	Artificial Intelligence & Machine Learning	2	0	0	**2**
9	Professional Core Course	PCC-CS495	Artificial Intelligence & Machine Learning Laboratory	0	0	2	**1**
10	Humanities and social sciences including Management Courses	HSMC401	Management - I (Finance & Accounting)	3	0	0	**3**
11	Humanities and social sciences including Management Courses	HSMC402	Universal Human Values – IV	3	0	0	**3**
12	Mandatory Courses	MC401	Environmental Sciences	0	0	0	**0**
13	Mandatory Additional Requirements (MAR)	MC481	Mandatory Additional Requirements (MAR)	0	0	0	**0**
14	Project	PROJ-CS401	Innovative Project – II	0	0	0	**1**
15	MOOCs (Mandatory for Honours)	MOOC 4	Massive Open Online Courses (Mandatory for B.Tech(Honours))	0	0	0	**1**
Total Credit Points of Semester [for B.Tech]				**20**	**1**	**14**	**29**
Total Credit Points of Semester [for B.Tech (Hons.)]							**30**

Semester : 5							
Sr. No	**Type of Course**	**Course Code**	**Course Title**	**Hours per week**			
				Lecture	**Tutorial**	**Practical**	**Credits**
1	Engineering Science Course	ESC501	Signals & Systems	3	0	0	**3**
2	Professional Core Courses	PCC-CS501	Database Management Systems	3	0	0	**3**
3	Professional Core Courses	PCC-CS591	Database Management Systems Laboratory	0	0	4	**2**
4	Professional Core Courses	PCC-CS502	Formal Language & Automata Theory	3	0	0	**3**
5	Professional Core Courses	PCC-CS503	Object Oriented Programming	2	0	0	**3**
6	Professional Core Courses	PCC-CS593	Object Oriented Programming Laboratory	0	0	4	**2**
7	Professional Core Course	PCC-CS504	Software Engineering	2	0	0	**2**
8	Professional Core Course	PCC-CS594	Software Engineering Laboratory	0	0	2	**1**
9	Humanities and social sciences including Management Courses	HSMC501	Humanities II (Principles of Management)	3	0	0	**3**
10	Professional Elective courses	PEC-CS501	Professional Elective-I (Neural Networks and Deep Learning / Cybersecurity)	3	0	0	**3**
11	Mandatory Courses	MC501	Constitution of India & Essence of Indian Knowledge Tradition	0	0	0	**0**
12	Humanities and social sciences including Management Courses	HSMC502	Universal Human Values – V	3	0	0	**3**
13	Mandatory Additional Requirements (MAR)	MC581	Mandatory Additional Requirements (MAR)	0	0	0	**0**
14	Project	PROJ-CS501	Innovative Project - III	0	0	0	**1**
15	MOOCs (Mandatory for Honours)	MOOC 5	Massive Open Online Courses (Mandatory for B.Tech(Honours))	0	0	0	**2**
Total Credit Points of Semester [for B.Tech]				**22**	**0**	**10**	**29**
Total Credit Points of Semester [for B.Tech (Hons.)]							**31**

Semester : 6							
Sr. No	**Type of Course**	**Course Code**	**Course Title**	**Hours per week**			
				Lecture	**Tutorial**	**Practical**	**Credits**
1	Professional Core Courses	PCC-CS601	Compiler Design	3	0	0	**3**
2	Professional Core Courses	PCC-CS691	Compiler Design Laboratory	0	0	4	**2**
3	Professional Core Courses	PCC-CS602	Computer Networks	3	0	0	**3**
4	Professional Core Courses	PCC-CS692	Computer Networks Laboratory	0	0	4	**2**
5	Professional Core Course	PCC-CS603	Cloud Computing & IOT	2	0	0	**2**
6	Professional Core Course	PCC-CS693	Cloud Computing & IOT Laboratory	0	0	2	**1**
7	Professional Elective Course	PEC-CS601	Professional Elective-II (Soft Computing / Human Computer Interaction)	3	0	0	**3**
8	Professional Elective Course	PEC-CS602	Professional Elective-III (Data Analytics / Blockchain Technology)	3	0	0	**3**
9	Open Elective Courses	OEC-CS601	Open Elective-I (Human Resource Development and Organizational Behavior)	3	0	0	**3**
10	Project	PROJ-CS601	Innovative Project -IV	0	0	6	**3**
11	Humanities and social sciences including Management Courses	HSMC602	Universal Human Values – VI	3	0	0	**3**
12	Mandatory Additional Requirements (MAR)	MC681	Mandatory Additional Requirements (MAR)	0	0	0	**0**
13	MOOCs (Mandatory for Honours)	MOOC 6	Massive Open Online Courses (Mandatory for B.Tech(Honours))	0	0	0	**1.5**
Total Credit Points of Semester [for B.Tech]				20	0	16	**28**
Total Credit Points of Semester [for B.Tech (Hons.)]							**29.5**

Semester : 7							
Sr. No	**Type of Course**	**Course Code**	**Course Title**	**Hours per week**			
				Lecture	**Tutorial**	**Practical**	**Credits**
1	Professional Core Course	PCC-CS701	Network Security & Cryptography	2	0	0	**2**
2	Professional Elective Courses	PEC-CS701	Professional Elective - IV (Speech and Natural Language Processing / Embedded Systems)	3	0	0	**3**
3	Professional Elective Courses	PEC-CS702	Professional Elective - V (Image Processing / Digital Forensics)	3	0	0	**3**
4	Open Elective Courses	OEC-CS701	Open Elective-II (Cyber Security / Data Analytics)	3	0	0	**3**
5	Project	PROJ-CS701	Innovative Project -V / Entrepreneurship	0	0	12	**6**
6	Humanities and social sciences including Management Courses	HSMC702	Universal Human Values – VII	3	0	0	**3**
7	Mandatory Additional Requirements (MAR)	MC781	Mandatory Additional Requirements (MAR)	0	0	0	**0**
8	MOOCs (Mandatory for Honours)	MOOC 7	Massive Open Online Courses (Mandatory for B.Tech(Honours))	0	0	0	**5**
Total Credit Points of Semester [for B.Tech]				14	0	12	**20**
Total Credit Points of Semester [for B.Tech (Hons.)]							**25**

Semester : 8							
Sr. No	**Type of Course**	**Course Code**	**Course Title**	**Hours per week**			
				Lecture	**Tutorial**	**Practical**	**Credits**
1	Professional Elective Courses	PEC-CS801	Professional Elective -VI (Quantum Computing / Cyber Law, IPR & Ethics)	3	0	0	**3**
2	Open Elective Courses	OEC-CS801	Open Elective-III (Cyber Law, IPR & Ethics / Neural Networks and Deep Learning)	3	0	0	**3**
3	Open Elective Courses	OEC-CS802	Open Elective-IV (Digital Forensics / Quantum Computing)	3	0	0	**3**
4	Project	PROJ-CS801	Innovative Project -VI / Entrepreneurship / Corporate Internship	0	0	12	**6**
5	Humanities and social sciences including Management Courses	HSMC802	Universal Human Values – VIII	3	0	0	**3**
6	Grand Viva	PCC-CS881	Grand Viva-Voce	0	0	0	**2**
7	Mandatory Additional Requirements (MAR)	MC881	Mandatory Additional Requirements (MAR)	0	0	0	**0**
8	MOOCs (Mandatory for Honours)	MOOC8	Massive Open Online Courses (Mandatory for B.Tech(Honours))	0	0	0	**5**
Total Credit Points of Semester [for B.Tech]				12	0	12	**20**
Total Credit Points of Semester [for B.Tech (Hons.)]							**25**

Total Credit Points from 1st to 8th Semester [for B.Tech]				**200**
Total Credit Points from 1st to 8th Semester [for B.Tech (Hons.)]				**220**

B.Tech 1st year 1st Semester

Physics
Code:BSC-101
Contact Hours: 3L
Credit: 4

Pre-Requisite: Basic knowledge of classical mechanics at XI, XII level, wave theory of light, Vector calculus, Differential and Integral calculus along with differential equations, concept of Cartesian and spherical coordinate, linear algebra and partial differential equation, probability and statistics, electrostatics and magneto-statics.

Course Outcome-

1. Develop a knowledge of classical mechanics for applications in engineering
2. Apply the knowledge of optics in varieties of technologies like optical instruments, optical software etc.
3. Develop ability to analyze and solve physical problems.
4. Develop knowledge of Electromagnetic theory for applications in engineering.
5. Formulate and solve the engineering problems on Quantum theory.
6. Apply the knowledge of Quantum mechanics in engineering applications.
7. Develop understanding of Statistical mechanics and their applications.

Topic:-
Module-1:
1. Vector: Ordinary integrals of vectors, Line Integrals, Surface Integrals and Volume Integrals. The Divergence Theorem of Gauss, Stokes' theorem, Greens' Theorem in the plane
2. Classical Mechanics: Constrained Motion, Discrete and Continuous Systems, Rigid and Elastic Bodies, Degrees of Freedom, Constraints- Holonomic and Non-Holonomic Constraints.

Module-2:
Oscillations:Free vibration, forced vibration and Resonance, Mathematical treatment of damped vibration, Time constant or Modulus of decay, Energy relations, Evaluation of α and ω_0, Logarithmic Decrement, Mathematical treatment of forced vibration, Expression for velocity in steady state, Resonance, Power in forced vibration and resonance, Work done against retarding force, Sharpness of resonance.

Module -3:
1. Interference:Applications- Young's Double Slit Experiment: width of interference fringes and Newton's rings
2. Diffraction:Fraunhofer and Fresnel diffraction, Fraunhofer diffraction at single slit, double slit, and multiple slits (qualitative analysis only); Rayleigh Criteria, Resolving Power of grating and telescope, Applications
3. Polarization: Introduction, Circular and Elliptical polarization, Polarisation by Reflection, Brewster's Law, Polarisation by Double Reflection, E-ray, O-Ray, Nicol Prism, Wave plates - Half wave plate and Quarter wave plate, Optical activity, Specific rotation, Fresnel theory of Optical rotation, Applications.
4. Laser: Spontaneous emission, Stimulated emission, Absorption, Principles and working of laser: Population inversion, Optical pumping, various methods of pumping, Einstein's A and B coefficients (Qualitative idea), Fibre Optics, Designing of LASER with example.

Module -4:
1. Electrodynamics:Maxwell's Equation: Electrodynamics before Maxwell, How Maxwell Fixed Up Ampere's Law, Maxwell's Equations and Magnetic Charge, Maxwell's Equations Inside Matter,

Poynting'stheorem
2. Electromagnetic Waves:The wave equation: Introduction, Electromagnetic waves in nonconducting media: Monochromatic plane waves in vacuum, Electromagnetic waves in conductors: The modified wave equation.

Module -5:
Quantum Theory:
1. Particle properties of Waves**:**Electromagnetic Waves, Blackbody Radiation, Ultraviolet Catastrophe, Planck radiation Formula, Photoelectric Effect, Quantum Theory of Light, Compton Effect
2. Wave properties of Particles**:**de Broglie Waves, Waves of Probability, Phase and Group Velocities, Particle Diffraction Uncertainty Principle (II), Applying the Uncertainty Principle.

Module -6:
Quantum Mechanics:Classical Mechanics is an approximation of Quantum Mechanics, Wave Function, Well Behaved Wave Functions, The Wave Equation, Schrodinger's Equation: Time dependent Form, Linearity and Superposition, Expectation Values, Operators, Schrodinger's Equation: Steady State Form, Particle in a Box, Finite Potential Well, Tunnel Effect, Planck Radiation Law, Free Electrons in a Metal

Module -7:
Statistical Distributions (Three different kinds) , Maxwell Boltzmann Statistics (Classical particles such as gas molecules obey them), Molecular energies in an ideal gas(Average molecular energy), Equipartition of Energy, Distribution of Molecular speeds , Quantum Statistics (Bosons and Fermions have different distribution function),Names of the functions, Bose-Einstein Condensate, Comparison of the three statistical distribution functions.

Text Books:

1. Theory and problems of Vector analysis –Murray R Spiegel, Schaum's outline series, McGraw-Hill book Company, SI (metric) edition
2. Theory and problems of Theoretical Mechanics by Murray R. Spiegel SI(Metric) edition.
3. Advanced Acoustics – Dr. D. P. Raychaudhuri, The new book stall, Revised Ninth Edition, 2009
4. A textbook on Optics, B. Ghosh and K. G. Majumder, Sreedhar Publishers, fifth edition
5. Introduction to Electrodynamics by David J. Griffiths 3rd Edition
6. Concepts of Modern Physics (Sixth Edition) by Arthur Beiser (Published by McGraw-Hill)

Physics Laboratory
Code: BSC-191
Contact Hours: 2L
Credit:1

Pre-Requisite: Basic knowledge about measurement techniques by vernier calipers and screw gauge. Basic concepts of 12^{th} standard physics. Basic knowledge of algebraic calculation and graph plot.

Course Outcome:
1. Develop familiarity with range of experimental methods.
2. Design, perform, document and analyze experiments in physics.
3. Learn to work in a group.
4. Verify the theories learnt with the help of instruments and measurement techniques, learn the sources of error in the experiment and calculate the error percentage

Topic:-

Module-1: Determination of the Young's modulus of elasticity of the material of a given bar by flexure method.

Module-2: Study the formation of Newton's rings in the air-film in between a plano-convex Lens and a glass plate using nearly monochromatic light and hence to determine the Radius of curvature of the plano-convex lens.

Module -3: Determination of the modulus of rigidity of the material of a rod by static / dynamic method.

Module -4: Determination of the wavelength of a given LASER source by forming diffraction pattern with a plane transmission grating.

Module -5: Study the Current vs. Voltage curve for a solar cell under various illumination conditions.

Module -6: Determination of Planck's constant by photoelectric emission process.

Module -7: Determination of the band-gap of a semiconductor by measuring the resistivity at different temperatures by four-probe method

Module -8: Calculation of Stefan- Boltzmann Constant using the concept of black body radiation

Module -9: Determination of e/m by Thomson's experiment. or Millikan oil drop experiment

Module -10: Determination of the resistance per unit length of a wire using Carey Foster bridge.

Module -11: Determination the excitation potential of a given gas by Franck-Hertz experiment.

Module -12: Melde's Experiment: To determine the frequency of a electrically driven Tuning Fork.

Module -13: Determination of acceleration due to gravity (g) using bar pendulum.

Text Books:

1. "Basic Electronics", by Debashis De and Kamakhya Prasad Ghatak, Pearson Publication
2. " Microelectronics Circuits Theory and Application" by Adel S.Sedra and Kenneth C.Smith, 6th Edition, Oxford International Student Edition

Mathematics and Statistics – I

Code: BSC103

Contact Hours: 3L

Credit: 3

Pre-Requisite:- High school mathematics

Course Outcome: -

1. Understand the domain of applications of mean value theorems and Taylor's series.
2. Apply the concept and techniques of differential and integral calculus to determine curvature and evaluation of different types of improper integrals, surface and volume of revolutions and identify extremum points of different surfaces of higher dimensions.
3. Can apply different test to check whether a sequence or series is convergent or divergent.
4. Understand scalar & vector fields, scalar point functions & vector point functions, Gradient of a scalar point function, Directional derivative, Divergence & curl of a vector point function.
5. Learn the measures of Central tendency, measures of dispersion and regression analysis. Learn basic rules of probability and Bayes' Theorem.

Topic:-

Module -1: Calculus of a single variable (Differentiation):

Rolle's Theorem, Mean value theorems, Taylor's and Maclaurin's theorems with remainders; Maclaurin's infinite series Application of Taylor's Theorem: Maxima and Minima of functions of One Variables**.** Indeterminate forms and L'Hospital rule; Evolutes and involutes.

Module -2: Calculus of a single variable (Integration): Definite Integral:
Definition, Properties of Definite Integrals.

Module -3: Applications of definite integrals:
Length, Area and Volume enclosed by plane curves. Evaluate surface areas and volumes of revolutions, Moment of Inertia. Products of inertia

Module -4: Improper integrals: Definition, classification, Test for convergence. Beta and Gamma function and their properties.

Module -5: Multivariate Calculus (Differentiation):

Limit, continuity and partial derivatives, Euler's theorem on Homogeneous function, Chain rule, Total derivative, derivative of implicit functions; Jacobians for two & three independent variables and related problems, Maxima, minima and saddle points; Method of Lagrange's undetermined multipliers.

Module -6: Vector Calculus:

Scalar & Vector fields, Scalar point functions & Vector point functions, Gradient of a scalar point function, Directional derivative related problems, Divergence & curl of a vector point function.

Module -7: Sequence and Series:
Preliminary ideas of sequence, Infinite series and their convergence/divergence, Infinite series of positive terms, Tests for convergence: Comparison test, Cauchy's Root test, D' Alembert's Ratio test, Raabe's test(statements and related problems on these tests), Alternating series, Leibnitz's Test (statement only) and related problems, Absolute convergence and Conditional convergence.

Module -8: Fundamental statistics:
Definition of statistics, necessity, understanding of data and representation of data. Measures of Central tendency- Mean, Median, Mode and the empirical relation among them. Related problems, Measures of Dispersion-Variance and its properties. Related problems, Moments (central; raw), Skewness and Kurtosis. Regression analysis.

Module -9: Theory of Probability:
Basic terminology, Classical & Axiomatic definition of probability, Some elementary deductions- $0 \leq \mathrm{P(A)} \leq 1, \mathrm{P}(\bar{\mathrm{A}}) = 1 - \mathrm{P(A)}$ etc., Addition rule for two events (proof) & three events (statement only) - Related problems, Concept of Conditional probability, Multiplication rule of probability, Bayes' theorem (statement only)-related problems, Independent events –properties and related problems.

Text Books:

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010.
2. Erwin kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006
3. Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint, 2010.

Basic Electrical Engineering
Code:ESC101
Contact Hours: 2L
Credit: 2

Pre-Requisite:- Basic Knowledge of Electrical circuits learnt in High school Physics

Course Outcome: -

1. The capability to know and implement the DC Network Theorem in electrical circuits.
2. The ability to describe the AC Fundamentals and learn about the Resonant Circuits
3. An understanding about the construction and working of Single Phase Transformer
4. A detailed knowledge about the working, starting and speed control of DC Machines
5. An introduction to the three phase and single phase Induction Motor
6. An overview about the Three Phase System
7. An understanding of the Working of Power Converters
8. A knowledge about the Electrical Installations of an Electrical Power System

Topics:-

Module-1:DC Circuits

Electrical circuit elements (R, L and C), voltage and current sources, Kirchhoff current and voltage laws, analysis of simple circuits with dc excitation. Superposition, Thevenin and Norton Theorems. Time-domain analysis of first-order RL and RC circuits.

Module-2: AC Circuits

Representation of sinusoidal waveforms, peak and rms values, phasor representation, real power, reactive power, apparent power, power factor. Analysis of single-phase ac circuits consisting of R, L, C, RL, RC, RLC combinations (series and parallel). Three phase balanced circuits, voltage and current relations in star and delta connections.

Module -3: Transformers

Principle of operation & construction, Emf equation, ideal and practical transformer, Impedance transformation, Phasor diagram on no load & full load, equivalent circuit, losses in transformers, regulation and efficiency, Open & Short circuit tests of a transformer.

Module -4: Electrical Machines

Generation of rotating magnetic fields, Construction and working of a three-phase induction motor, Significance of torque-slip characteristic. Loss components and efficiency, starting and speed control of induction motor. Construction, working, Excitation schemes of DC machines, Emf equation, Torque equation, Armature reaction, Torque-speed characteristic and speed control of separately excited dc motor, Synchronous generator, Overview of single phase induction motor.

Module 5: Power Converters

DC-DC buck and boost converters, duty ratio control. Single-phase and three-phase voltage source inverters; sinusoidal modulation.

Module 6: Electrical Installations

Components of LT Switchgear: Switch Fuse Unit (SFU), MCB, ELCB, MCCB, Types of Wires and Cables, earthing. Types of Batteries, Important Characteristics for Batteries. Elementary calculations for energy consumption, power factor improvement and battery backup.

Text Books:

1. D. P. Kothari and I. J. Nagrath, “Basic Electrical Engineering”, Tata McGraw Hill, 2010.
2. D. C. Kulshreshtha, “Basic Electrical Engineering”, McGraw Hill, 2009.
3. L. S. Bobrow, “Fundamentals of Electrical Engineering”, Oxford University Press, 2011.
4. E. Hughes, “Electrical and Electronics Technology”, Pearson, 2010.

5. V. D. Toro, “Electrical Engineering Fundamentals”, Prentice Hall India, 1989.

Basic Electrical Engineering Laboratory
Code: ESC191
Contact Hours: 2L
Credit: 1

Pre-Requisite:- Basic Knowledge of Electrical circuits learnt in High school Physics

Course Outcome: -

1. Apply the basic concepts of Electrical Engineering in the design and installation of Electrical Systems
2. Compute the response of DC circuits using network theorems
3. Describe the elements of AC circuits and the phasor concept
4. Design resonance circuits and evaluate the condition of resonance for series and parallelcircuits
5. Ability to Understand about the Single Phase Transformer
6. Design the circuit for Starting and Speed Control of DC Motor

Topic:-

Module-1: First activity: Introduction to basic safety precautions and mentioning of the do’s and Don’ts. Noting down list of experiments to be performed, and instruction for writing the laboratory reports by the students. Group formation. Students are to be informed about the modalities of evaluation.

Module-2: Introduction and uses of following instruments:

(a) Voltmeter
(b) Ammeter
(c) Multimeter
(d) Oscilloscope

Demonstration of real life resistors, capacitors with color code, inductors and auto transformer.

Module -3: Demonstration of cut-out sections of machines: DC machine, Induction machine, Synchronous machine and single-phase induction machine.

Module -4: Calibration of ammeter and Wattmeter.

Module -5: Verification of network theorems (Thevenin Theorem, Superposition Theorem).

Module -6: Analysis of R-L-C circuit (Calculation of impedance, Power Factor, Steady State Response, Transient Response, Resonating frequency, Q factor)

Module -7: Open circuit and short circuit test of a single-phase transformer

Module -8: Demonstration of three phase transformer connections. Voltage and current relationship, phase shifts between the primary and secondary side.

Module -9: Measurement of power in a three-phase unbalanced circuit by two wattmeter method.

Module -10: Determination of Torque –Speed characteristics of separately excited DC motor.

Module -11: Speed Control of DC Shunt Motor.

Module -12: Determination of Torque speed characteristics and observation of direction reversal by change of phase sequence of connection of Induction motor.

Module -13: Determination of operating characteristics of Synchronous generator.

Module -14: Demonstration of operation of (a) DC-DC converter (b) DC-AC converter (c) DC-AC converter for speed control of an Induction motor

Module -15: Demonstration of components of LT switchgear.

Text Books:

1. D. P. Kothari and I. J. Nagrath, "Basic Electrical Engineering", Tata McGraw Hill, 2010.
2. D. C. Kulshreshtha, "Basic Electrical Engineering", McGraw Hill, 2009.
3. L. S. Bobrow, "Fundamentals of Electrical Engineering", Oxford University Press, 2011.
4. E. Hughes, "Electrical and Electronics Technology", Pearson, 2010.
5. V. D. Toro, "Electrical Engineering Fundamentals", Prentice Hall India, 1989.

Essential Studies for Professionals – I
Code: HSMC102
Contact Hours: 2L
Credit: 2

Pre-Requisite:- Basic & fundamental knowledge of mathematics up to class 10th standard, Logical & Analytical skill.

Course Outcome: -

1. Students will learn advance tricky approach for solving Quantitative Aptitude questions.
2. It will enhance students skill to appear in various aptitude test within limited time constrain.
3. This module will enhance student's Analytical skill &will also improve quick decision making skill.
4. Students can prepare various competitive exams and different placement aptitude test as well.

Topic:-
Module 1: Quantitative Aptitude

1) Quant foundation- Vedic Maths& Collective tricks.

2) Basic Multiplication – multiplying by numbers ending in zeroes, Multiplying by 2,3,4,5,6,7,8,9, 11,12 & 111. Multiplying 2 digits numbers ending in 9 & whose tens digit at to 10, Multiplying by 2 digits number of 9, multiplying by any 2-digit numbers ending in 9

3) Division- Divisibility by 2,3,4,5,6,7,8, 9, 11 & 13; Dividing by 5, 9, 15, 25,125, Dividing by Factors.

4) Squaring numbers- squaring any 2-digit numbers ending in 5, squaring any number ending in 5,squaring any 3digit numbers ending with 25, squaring any numbers ending in 9, squaring any numbers consisting only nines. Squaring any 2-digit numbers. Cube & cube roots.

5) Percentage- Basic concept of percentage &it's shortcut rules & their applications.

6) Ratio- Basic concept of Ratio & Proportion, Shortcut tricks & their applications.

7) **Simple equation**- Linear equation of 2& more than two variables.
8) **Variation**- Ratio, Proportion, Variation, concept of directly proportional&
9) **Partnership** – concept, rules & Applications, Percentage Advanced problems &shortcuts.
10) **Profit & Loss**- Basic concept, formulae, shortcut tricks & their application.

Module 2: Logical Mental ability -1

1) **Coding And Decoding & Direction Sense**

a) Conditional Coding, b) Word-Pattern Coding, c) Chinese Coding, d) Direction Sense Test, e) Direction Distance Test, f) Shadow based Questions

2) **Series &Numbers**

a) Alphabet Series, b) Random Series, c) Number Series, d) Letter Gap, e) Missing Number Series, f) Series Completion, g) Order and Ranking, h) Interchange, i) Comparison

3) **Blood Relations**

Family Tree Questions, Indication Type BR, Coding Blood Relations, Miscellaneous Blood Relations

4) **Analogy**

Word Analogy, Classification, Odd-Out

Text Books:

1. Fast Track Arithmetic- RajeshVerma
2. Verbal & non-verbal reasoning- R.SAgarwal
3. Quantitative Aptitude- R.SAgarwal
4. Analytical Reasoning –Peeyush Bhardwaj

Workshop & Manufacturing Practices –I
Code: ESC193
Contact Hours: 2L
Credit: 1

Pre-Requisite: -Knowledge in dimensions and units, Usage of geometrical instruments and analytical ability.

Course Outcome: -

1. Upon completion of this laboratory course, students will be able to fabricate components with their own hands.
2. They will also get practical knowledge of the dimensional accuracies and dimensional tolerances possible with different manufacturing processes.
3. By assembling different components, they will be able to produce small devices of their interest.

Topic:-
Module 1: Machine shop (10 hours) Typical jobs that may be made in this practice module: To make a pin from a mild steel rod in a lathe.
To make rectangular and vee slot in a block of cast iron or mild steel in a shaping and / or milling machine.

Module 2: Fitting shop (8 hours) Typical jobs that may be made in this practice module: To make a Gauge from MS plate.

Module 3: Carpentry (6 hours) Typical jobs that may be made in this practice module: To make wooden joints and/or a pattern or like.

Module 4: Welding shop (8 hours) (Arc welding 4 hrs + gas welding 4 hrs) Typical jobs that may be made in this practice module:
ARC WELDING (4 hours): To join two thick (approx 6mm) MS plates by manual metal arc welding.
GAS WELDING (4 hours): To join two thin mild steel plates or sheets by gas welding.

Module 5: Casting (8 hours) Typical jobs that may be made in this practice module: One/ two green sand moulds to prepare, and a casting be demonstrated.

Module 6: Smithy (6 hours) 4 hours Typical jobs that may be made in this practice module: A simple job of making a square rod from a round bar or like.

Text Books:

1. Hajra Choudhury S.K., Hajra Choudhury A.K. and Nirjhar Roy S.K., "Elements of Workshop Technology", Vol. I 2008 and Vol. II 2010, Media promoters and publishers private limited, Mumbai.
2. Kalpakjian S. And Steven S. Schmid, "Manufacturing Engineering and Technology", 4th edition, Pearson Education India Edition, 2002.
3. Gowri P. Hariharan and A. Suresh Babu,"Manufacturing Technology – I" Pearson Education, 2008.
4. Roy A. Lindberg, "Processes and Materials of Manufacture", 4th edition, Prentice Hall India, 1998.
5. Rao P.N., "Manufacturing Technology", Vol. I and Vol. II, Tata McGrawHill House, 2017.

Skill Development for Professionals – I
Code:HSMC182
Contact Hours: 2L
Credit: 1

Pre-Requisite:- A student should essentially possess the pre-requisite knowledge of grammatical and practical applications of verbal English along with the basic skills of logical and quantitative applications.

Course Outcome: -

1. It will improve verbal ability skill among students.
2. Students will communicate effectively & appropriately in real life situation.
3. It will enhance students' problem solving skill.
4. Students will be able to prepare for various public and private sector exams & placement drives.

Topic: -
Module- 1: Objective English-1

1. Introduction of Parts of speech: Introduction, Brief discussion of Parts ofspeech
2. What is noun, Kinds of Noun, Rules &Application.
3. Definition of Pronoun, Examples, Rules & Application
4. Definition of Verb, Kinds of Verb, Rules & Application, Definition of Tense, Different types of Tenses, Examples, Rules &Application
5. Definition of Adjective, Kinds of Adjective, Rules &Application,
6. Definition of Adverb, Kinds of Adverb, Rules &Application
7. Definition of Preposition, Examples, Rules &Application,
8. Definition of Interjection, Examples, Rules & Its Application,
9. Definition of Conjunction, Examples, Rules &Application
10. Different types of Articles, Examples, Rules& Application English Grammar.
11. Newspaper reading: The Hindu & Economic Times.

Module- 2: Data Interpretation level-I.

Text Books:

1. Fast Track Arithmetic- RajeshVerma
2. Verbal & non-verbal reasoning- R.SAgarwal
3. Quantitative Aptitude- R.SAgarwal
4. Analytical Reasoning –PeeyushBhardwaj

Computer Programming for Problem Solving Using Python & C-I
Code: ESC181
Contact Hours: 3L
Credit: 2

Pre-Requisite:- Basic knowledge of Computers learnt in High school

Course Outcome: -

1. To learn about basics of computation & principles of Computer Programming.
2. To impart the basic concepts of digital computers.
3. To impart the basic concepts of C programming language through C character set, expression, operators.
4. Fundamentals of C through Standard input and output Flow of Control and Program Structures.
5. To impart the basic knowledge on C array, function, pointers and file handling.
6. Impart the knowledge of real life projects on programming language.

Topic:-

Module 1: Introduction to Programming: Introduction to components of a computer system (disks, memory, processor, where a program is stored and executed, operating system, compilers etc.) Idea of Algorithm: steps to solve logical and numerical problems. Representation of Algorithm: Flowchart/Pseudo code with examples. From algorithms to programs; source code, variables (with data types) variables and memory locations, Syntax and Logical Errors in compilation, object and executable code

Module 2: Arithmetic expressions and precedence

Module 3: Conditional Branching and Loops Writing and evaluation of conditionals and consequent branching, Iteration and loops

Module 4: Arrays

- Arrays (1-D, 2-D)
- Character arrays and Strings

Module 5: Basic Algorithms

- Notion of order of complexity through example programs
- Searching
- Basic Sorting Algorithms (Bubble, Insertion).

Module 6: Function

- Functions (including using built in libraries)
- Parameter passing in functions, call by value
- Passing arrays to functions: Call by reference
- Return by reference

Module 7: Recursion

- Recursion, as a different way of solving problems. Example programs, such as Finding Factorial, Fibonacci series, Ackerman function etc.
- Quick sort or Merge sort.

Module 8: Structure

- Structures, Defining structures and Array of Structures

Module 9: Pointers

- Idea of pointers
- Defining pointers
- Use of Pointers in self-referential structures
- Notion of linked list (no implementation)

Module 10: File handling

Text Books:

1. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice Hall of India
2. Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill
3. E. Balaguruswamy, Programming in ANSI C, Tata McGraw-Hill
4. ReemaThareja, Computer Fundamentals and programming in C, Oxford University PressYashavantKanetkar, Let Us C, BPB Publications

English Communication and Public Speaking Skills –I
Code: HSMC101
Contact Hours: 2L
Credit: 2

Pre-Requisite: Basic Grammar, Comprehension, Writing skills and Basic Communication.

Course Outcome: -

1. The course will facilitate students to communicate effectively in academic and social contexts.
2. It will enable students acquire vocabulary and enrich their speaking skills.
3. It will help students to be industry ready.
4. It will help students acquire basic proficiency in English including reading and listening comprehension, writing and speaking skills.

Topics:-
Module-1:
Basic Communication Skills:

a) Purpose of communication and Importance of building relationship through communication(TB: Part1,Chap-1,2)
b) Key Factors in Building great relationship (TB: Part1,Chap-1,2)
c) Understanding Inter and Crosscultural nuances (TB: Part1,Chap-1,2)
d) CBLL (Content Based language learning)(TB: Part1,Chap-1)

Module-2:

Fundamentals of Grammar:

a) Types of Nouns(TB: Chap 5-8, pg 5-15)
b) Types of Pronouns(TB: Chap 15-19, pg43-62)
c) Various Forms and Moods of Verbs (TB: Chap 20,21,23Pg 65-77, Chap 31-33pg 102-117)
d) Gerund (TB: Chap 30,pg 99-100)
e) Adverbs and its Usages (TB: Chap 34-37, pg 118-125)

Module-3:

Communicative Grammar:

a) Varieties of English TB: (Part 1, pg9-20)
b) Intonation (TB: Part 2,pg 21-25)
c) Mood, Emotion and Attitude of sentences (TB: Part 3, pg 117-138)
d) Linking of Words and sentences (TB: Part 3, pg-139-158)

Module-4:

Business writing Skills:

a) Business writing language(TB: Part 2,Chap-3)
b) Structuring of Messages and Presentation(TB: Part 2,Chap-4)
c) Online Writing: Email, Websites, Blogs and Social Networking(TB: Part 3,Chap-6,7)
d) Writing Enquiries, Quotations, Invoice, Tenders(TB: Part 4,Chap-9,10,11)
e) Business Correspondences(TB: Part 4,Chap-15)

Module-5:

Advanced Writing Skills:

a) Proposal writing: project proposal for getting funds for university building, road repairing, startup of website, establishment of share trading company, proposal for building construction business. (TB: Part 5, Chap-20)
b) Secretarial and Administrative Correspondence(TB: Part 5,Chap-17)
c) Meeting Documentation (TB: Part 5, Chap-18)
d) Complaints and Adjustment Letters (TB: Part 6, Chap-21)
e) Writing Notice, Advertisement and Circular (TB: Part 6, Chap-23)

Module-6:

Reading Science Fiction:

a) Nathaniel Hawthorne: The Birth Mark (pg 19)
b) Herman Melville: The Bell Tower (pg 37)
c) E.M. Forster: The Machine Stops (pg 109)

Text Books:

1. Model Business Letters, Emails And Other Business Documents by Shirley Taylor, Pearson Publication, 7th Edition
2. A Communicative Grammar of English by Geffrey Leech & Jan Svartvik, Routledge Publication, 3rd Edition
3. High School English Grammar and Composition by Wren and Martin, S Chand publication, 2nd Edition
4. The Phoenix Pick Anthology of Classic Science Fiction Stories by Arc Manor 2008, ISBN: 978-1-60450-258-9, 2nd Edition

English Communication and Public Speaking Skills Laboratory –I
Code: HSMC191
Contact Hours: 2L
Credit: 1

Pre-Requisite: -Language Acquisition model, Technological aids for language simulation, Hands-on Training and practice

Course Outcome: -

1. The course will facilitate students to understand the codes and conducts of Business communication.
2. It will help students acquire proper body language, speaking nuances in order to become industry ready.
3. It will enable students experience real-life interview situations through various simulation based lab experiments.
4. It will help in students' brain storming through various real-life situations. Enabling leadership qualities through mock-interview, telephonic conversations and group communication amongst students.

Topics:-
Module-1:
Development of Listening skills:

a) Casual and academic listening (Text Book, Chap 11)
b) Listening to Speeches and evaluating them(Text Book, Chap 11)

Module-2:
Hands on Practice of Reading Skills and its sub skills:

a) Skimming and scanning, extensive reading, newspaper reading (Text Book, Chap 7)
b) Reading non/technical passage, graphics, diagrams etc. (Text Book, Chap 7)

Module-3:
Creative Writing Skills:

a) Creative writing (Text Book, Chap 1)
b) Writing a piece of Fiction(Text Book, Chap 1)
c) Dialogues writing on day-to-day situation(Text Book, Chap 1)

Module-4:
Acquiring Speaking Skills:

a) Storytelling (Text Book, Chap 4)
b) Discussion about current affairs, mock job/ placement interviews. (Text Book, Chap 5)

Module-5:
Public speaking skills: Level 1

a) Introducing Oneself (Text Book, Chap 5)
b) Impromptu speech Delivery (Text Book, Chap 5)
c) Creating a digital/online profile: LinkedIn, video CV. (Text Book, Chap 5)

Module-6:
Public speaking skills: Level 2

a) Developing persuasive skills- Turncoat and debate(Text Book, Chap 10)
b) Group Discussion on factual, controversial and abstract issues (Text Book, Chap 10)

Module-7:
Leadership Skill Development

a) Strategies for making and working in a group (Text Book, Chap 5)
b) Features of a group leader (Text Book, Chap 5)

Module-8:
Soft Skill Acquisition

a) Business Etiquette, Formal approach in work field, Codes of Conduct, Body Language, Non-verbal techniques of Communication (Text Book, Chap 2)
b) Developing Intra and Interpersonal Skills through practice, Acquiring Business attributes (Text Book, Chap 2)

Text Books:

1. English Language Laboratories: A Comprehensive Manual by NiraKonar, PHI Publication, 2nd Edition
2. A Manual For English Language laboratory by D. Sudha Rani, Pearson Publication, 2011 Edition

Design Thinking & Innovation- I
Code: HSMC183
Contact Hours: 2L
Credit: 0.5

Pre-Requisite:- None

Course Outcome: -

1. The course titled Design Thinking & Innovations is designed to give an in-depth understanding on various aspects of thinking innovations, creativity, evolving business models, incubation and entrepreneurship.
2. The course also includes sessions on Engineering and Technology incubation which will help everyone as a game changer in nowadays competitive scenario.
3. The course is a blend of theory and practice. As the course is designed for B. Tech 1st year students therefore this course does not require any prerequisite knowledge except Mathematics and Basics of C programming language and will be useful to understand innovation and its applications in different areas of development and growth.

Topic:-
Module 1:
1. Introduction to Design thinking
2. Empathy: Problem Discovery & Evoking the 'right problem'
3. Solve:Concepting and Building – Generating Ideas, Building Ideas and Create a Concept
4. Testing, Refine and Enhance Design

Assignment: Submission of unique 3 (three) MCQs that are not repetitive among your friends based on the concepts of Design thinking.

Module 2: Research and Analysis: Context Research and Design Insights and Strategy How to write abstract, introduction, literature survey, conclusion, references.
Assignment-1: Submission of a research paper (max 4 in a group or individual).
Assignment-2: Presentation of the research paper.

Module 3: Design and implement the following projects: Describe each of the projects under the following headings: 1. Requirements, 2. Working principle, 3. Circuit Diagram or Block Diagram, 4. Conclusions, 5. Remarks, 6. References.

Text Books: None

Economics, Finance and Entrepreneurship Skills – I
Code: HSMC181
Contact Hours: 2L
Credit: 1

Pre-Requisite:- High school Mathematics

Course Outcome: -

1. Upon completion of this laboratory course, students will be able to fabricate components with their own hands.
2. They will also get practical knowledge of the dimensional accuracies and dimensional tolerances possible with different manufacturing processes.
3. By assembling different components, they will be able to produce small devices of their interest

Topic:-

MODULE 1: INTRODUCTION TO ECONOMICS & CONCEPT OF DEMAND SUPPLY:

a) Meaning and Definition of economics
b) Micro economics and Macro economics
c) Supply and Demand (only basics)
    - Law of demand
    - Law of supply
    - Equilibrium and price determination

MODULE 2: CONCEPT OF PRODUCTION AND COST

a) Meaning of production
b) Functions of production
c) Factors of production
d) Concept of short run and long run
e) Concept of Revenue
f) Cost (types only)
g) Break even analysis

MODULE 3: TYPES OF MARKETS AND THEIR CHARACTERISTICS

a) Meaning of market
b) Types of Market (only basic concepts for each market types)
c) Perfect competition
d) Monopoly
e) Monopolistic competition
f) Oligopoly

MODULE 4: Finance

a) Definition of Finance
b) Objectives of Financial management – profit maximisation, wealth maximisation

c) Functions of financial management.

MODULE 5::Entrepreneurship

a) Definition of Entrepreneurship
b) Need for entrepreneurship
c) Characteristics of an entrepreneur.
d) Difference of Entrepreneurship from innovations.
e) Types of entrepreneurship.

Text Books:

1. Acemoglu, D., Laibson, D., & List, J. (2018). Microeconomics, 2nd Edition, Boston: Pearson Education.
2. Pindyck, R., &Rubinfeld, D. (2018). Microeconomics, 9th Edition, Boston: PearsonEducation.
3. Krugman, P., & Wells, R. (2018). Microeconomics, 5th Edition, New York: Worth Publishers.
4. Mankiw, G. (2017). Principles of Microeconomics, 8th Edition, Boston: Cengage Learning.

Mandatory Additional Requirements (MAR)
Code: MC181
Credit: 0.5

Massive Open Online Courses (Mandatory for B.Tech (Honours))
Code: MOOC 1
Credit: 2

B.Tech 1st year 2nd Semester

Chemistry
Code: BSC202
Contact Hours: 3L
Credit: 4

Pre-Requisite:

- Fundamental ideas of inorganic chemistry and DNA sequencing at XI, XII level.
- Basic knowledge of conductors, insulators and semi- conductors.
- Introduction to Organic Molecules and their orientation.
- Knowledge of the basic concepts of thermodynamics.
- Knowledge of electromagnetic spectrum, photons and its properties along with Planck's Hypothesis.

Course Outcome: -

1. Know about the theoretical concepts and find its application in diversified field and interdisciplinary research.
2. To extend this knowledge in solving problems of other domains and mapping the course content into core areas of allied streams.
3. Able to apply different theoretical concepts in real life applications.
4. Be able to analyze and interpret data to produce meaningful conclusions and recommendations.

5. Develop ability to analyze and solve physical problems.

Topic:-

Module 1: Fundamental Chemistry:

1.Acid base, concept of pH and pOH, buffer solutions, ionic equilibria, solubility equilibria, Ostwald's dilution law, electrolytic conductance.

2.Coordination Chemistry: Definitions and classification of ligands, coordination number and stereochemistry, isomerism, Crystal Field Theory, Crystal field splitting of d-orbitals in octahedral complexes and tetrahedral complexes, Crystal Field Stabilisation Energy, Colors and magnetism of Coordination Complexes.

Module 2: Chemistry of Smart Materials:

1.Introduction to conductor, semiconductor, insulator, band structure of solids and the role of doping on band structures.

2.Chemistry of Nanostructures, Nanocomposites, graphene and other 2D materials.

Module 3: Organic reactions mechanism:

Introduction to reactions involving substitution, addition, elimination, cyclization and ring openings. Steric hindrance, Hydride and alkyl shift, Aldol condensation, Beckmann rearrangement, Cannizzaro reaction, Diels Alder reaction, Hoffmann reaction.

Module 4: Computational Chemistry:

Bioinformatics: Biology as an information science, history of bioinformatics, types of data, introduction to DNA, genome organization, introduction to different resources of bioinformatics and application.

Module 5: Spectroscopic techniques and applications:

Introduction, Types of energy present in molecules, Types of spectra, General features of absorption spectrometer, selection rules, Frank Condon Principle, Ultraviolet and Visible spectra, Microwave Spectroscopy, Vibrational Spectroscopy, Electronic spectroscopy. Fluorescence and its applications

Module 6: Thermodynamics:

Introduction, Terminology of thermodynamics, Zeroth Law of thermodynamics, 1st law of thermodynamics, Enthalpy, Reversible Isothermal expansion, Thermochemical definition, Hess's law of constant heat summation, Heat capacity, Relation between Cp and Cv, Adiabatic expansion, Kirchoff's equation, 2nd law of thermodynamics, Carnot's theorem, Entropy, Entropy change in reversible process, Entropy change in irreversible process., Entropy of phase transition, Entropy change for ideal gas, Entropy change during mixing of ideal gases, Free energy, Joule-Thomson effect, Gibbs Helmholtz equation, Maxwell's thermodynamic relations, ClausiusClapeyron equation.

Module7: Electrochemistry and electromotive force:

Free energy and emf, Cell potentials, Nernst equation and applications, Redox Reactions, Electrode Potential, Electrochemical Cell, Weston Standard Cadmium Cell, Emf of an Electrochemical Cell, Concentration Cell, Reference Electrodes, Batteries, Fuel Cells**.**

Text Books:

1. Engineering Chemistry by Jain and Jain, DhanpatRai Publishing Co.17th edition
2. Chemistry by PrasantaRath and SubhenduChakraborty
3. Physical Chemistry by P. W. Atkins
4. Fundamentals of Molecular Spectroscopy by C. N. Banwell
5. Physical Chemistry, P.C. Rakshit, Sarat Book distributors, Calcutta, 7th ed

6. University chemistry by B. H. Mahan
7. A Textbook of Nanoscience and Nanotechnology Author: T. Pradeep. Publisher: McGraw Hill Education, ISBN: 9781259007323
8. The Chemistry of Nanomaterials, Prof. C.N.R. Rao, Publisher-Wiley-VCH, ISBN: 3527306862

Chemistry Laboratory
Code: BSC292
Contact Hours: 2L
Credit: 1

Pre-Requisite:

- Fundamental ideas of inorganic chemistry and DNA sequencing at XI, XII level.
- Basic knowledge of conductors, insulators and semi- conductors.
- Introduction to Organic Molecules and their orientation.
- Knowledge of the basic concepts of thermodynamics.
- Knowledge of electromagnetic spectrum, photons and its properties along with Planck's Hypothesis.

Course Outcome: -

1. The objective of Chemistry Lab course is to make students familiar with practical knowledge of the basic phenomenon of chemistry.
2. Acquiring practical knowledge in chemistry the students are able to solve problems related to industrial and engineering field by themselves.
3. The students will gain knowledge to understand the practical chemistry related problems and analyze them in diverse field of industrial and engineering wings.
4. Chemistry practical knowledge will develop experimental skills and develop competency in technical field.

Topic:-
Module 1: Determination of the concentration of strong acid by standardized NaOH solution.
Module 2: Determination of the alkalinity present in water.
Module 3: Determination of the hardness of water present in the given sample of water.
Module 4: Determination of the P^H of different types of water by digitalP^H
Module 5: Determination of the conductance of a given sample of water by digital conductivitymeter.
Module 6: Determination of the Chemical Oxygen Demand by titration
Module 7: Determination of the viscosity of solution by viscometer.
Module 8: To determine chlorideionina given water sample by Argentometric method (using chromate indicator solution)

Text Books:

1. Engineering Chemistry by Jain and Jain, DhanpatRai Publishing Co.17th edition
2. Chemistry by PrasantaRath and SubhenduChakraborty
3. Physical Chemistry by P. W. Atkins
4. Fundamentals of Molecular Spectroscopy by C. N. Banwell
5. Physical Chemistry, P.C. Rakshit, Sarat Book distributors, Calcutta, 7th ed
6. University chemistry by B. H. Mahan
7. A Textbook of Nanoscience and Nanotechnology Author: T. Pradeep. Publisher: McGraw Hill Education, ISBN: 9781259007323
8. The Chemistry of Nanomaterials, Prof. C.N.R. Rao, Publisher-Wiley-VCH, ISBN: 3527306862

Mathematics and Statistics – II
Code:BSC203
Contact Hours: 3L
Credit: 3

Pre-Requisite: BSC103

Course Outcome: -

1. Learn to solve first order first degree, first order higher degree and higher order 1 st degree ordinary differential equations.
2. Learn to apply ordinary differential equation to solve problems in chemistry, physics and engineering.
3. Learn the applications of double and triple integrals, scalar and vector line integrals, scalar and vector surface integrals, theorems of Green, Gauss and Stokes.
4. Learn different types of matrices, concept of rank, methods of matrix inversion and their applications.
5. Understand Vector spaces; apply the concept of eigen values, Eigen vectors, diagonalization of matrices and orthogonalization in inner product spaces for understanding physical and engineering problems**.**

Topic:-

Module 1: Ordinary Differential Equations:

Definition, Order and Degree, Formation (from real life) and Significances of ODE, Condition of existence of solution of ODE. Classification of ordinary differential equation.

First order and first degree: Exact equations, condition of exactness, solution of exact differential equation. Non exact Differential equation (reducible to exact form): Rules for finding Integrating Factors, Linear equation, Bernoulli's equation.

First order and higher degree:Equations not of first degree: equations solvable for p, equations solvable fory,equationssolvableforxandClairaut's equation.

Higher order and first degree: General linear ODE with constant coefficients, C.F. & P.I., D-operator methods for finding P.I., Method of variation of parameters, Linear differential equation with variable coefficients: Cauchy-Euler equations, Solution of simultaneous linear differential equations.

Module 2: Applications of Ordinary Differential equations:

Geometric Applications of ODE: Orthogonal Trajectories. Physical applications of ODE: Problems related to: Motion of a boat across a stream,Resisted vertical motion, Rotating cylinder containing liquid, Velocity of escape from earth, Discharge of water from a small hole, Atmospheric pressure, Simple Electrical circuits, Newton's Law of cooling, Heat flow, Rate of decay of radioactive materials, chemical reactions and solutions. Application of Linear Differential Equations: Problems related to Simple Harmonic Motion, Simple pendulum, Oscillation of a spring, Oscillatory electrical circuit, Electromechanical analogy, Deflection of beams, Whirling of shafts. Application of Linear Simultaneous Differential Equations: Projectile with resistance.

Module 3:Multivariate Calculus (Multiple Integration):

Double integrals (Cartesian), Change of order of integration in double integrals, Change of variables (Cartesian to Polar), Applications: Areas, Volumes, Center of mass and gravity (constant and variable densities); Triple integrals (Cartesian), Orthogonal curvilinear coordinates, simple applications involving cubes, spheres and rectangular parallelepipeds; scalar and vector line integrals, scalar and vector surface integrals, theorems of Green, Gauss and Stokes.

Module 4:Linear Algebra (Matrix and Determinant):

Matrices, symmetric, skew symmetric and orthogonal matrices, vectors, addition and scalar multiplication of matrices, matrix multiplication, System of linear equations, Linear independence, Rank of a matrix, Determinants, Cramer's rule, Inverse of a matrix, Gauss elimination and Gauss Jordan elimination.

Module 5:Linear Algebra (Vector Space):

Vector space, linear dependence of vectors, Basis, Dimension; Linear transformation (Maps), Range and Kernel of linear map, Rank and Nullity, Inverse of a linear transformation, Rank-Nullity theorem (Sylvester's Law), composition of linear maps, matrix associated with linear map.

Eigen values, Eigen vectors, Eigen Bases, Diagonalization, Inner Product Spaces, Gram-Schmidt process for orthogonalization.

Text Books:

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010.
2. Erwin kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006
3. Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint, 2010.

Basic Electronics Engineering
Code: ESC201
Contact Hours: 2L
Credit: 2

Pre-Requisite: High school knowledge of Maths, Physics and electronics concepts learnt in physics.

Course Outcome: -

1. To be able to identify semiconductor materials, distinguish between types of semiconductor.
2. To be able to explain the junction properties and the phenomenon of rectification, I-V characteristics and identify operating points.
3. To be able to draw and explain the I-V characteristics of BJTs– both input and output, biasing and its application as switch as well as amplifier.
4. To be able to understand the concept of field effect transistor, operational amplifier and its application**.**

Topic:-

Module 1:Semiconductor fundamentals:

Introduction, Crystalline Materials and Semiconducting materials, Basis of Classification: Metals, Insulators and Semiconductors, Intrinsic Semiconductor, Extrinsic Semiconductors, Electrical Conduction Phenomenon

Module 2:Diode fundamentals:

Introduction, Formation of the p-n Junction, Energy Band Diagram, Models of the p-n Junction, I-V Characteristics of a p-n Junction Diode, Breakdown Diode, Special Types of p-n junction Semiconductor Diodes.

Module 3: Bipolar Junction Transistor:

Construction, Operation, Amplifying Action, Common Base, Common Emitter and Common Collector Configurations, Operating Point;

Module 4: Field Effect transistor:

Construction, Characteristics of Junction FET, Depletion and Enhancement type Metal Oxide Semiconductor (MOS) FETs.

Text Books:

1. "Basic Electronics", by Debashis De and Kamakhya Prasad Ghatak, Pearson Publication
2. " Microelectronics Circuits Theory and Application" by Adel S.Sedra and Kenneth C.Smith, 6th Edition, Oxford International Student Edition

Basic Electronics Engineering Laboratory
Code: ESC291
Contact Hours: 2L
Credit: 1

Pre-Requisite: High school knowledge of Maths, Physics and electronics concepts learnt in physics.

Course Outcome: -

1. To give practical knowledge of some basic electronic components and circuits
2. To introduce basics of pn junction diode and its applications
3. To understand the current-voltage characteristics of zener diode
4. To understand the current-voltage characteristics of Bipolar Junction Transistors in common emitter and common base configuration

Topic:-
Module 1: Study of different components like resistors, capacitors and inductors
Module 3: Study of v-i characteristics of p-n junction diode
Module 4: Study of output characteristics of full wave rectifier circuit'
Module 5: Study of output characteristics of half wave rectifier circuit
Module 6: Study of the characteristics of Zener diode
Module 7:

a) Study of input characteristics of BJT in common emitter configuration
b) Study of output characteristics of BJT in common emitter configuration

Module 8:

a) Study of input characteristics of BJT in common base configuration
b) Study of output characteristics of BJT in common base configuration

Text Books:

1. "Basic Electronics", by Debashis De and Kamakhya Prasad Ghatak, Pearson Publication
2. " Microelectronics Circuits Theory and Application" by Adel S.Sedra and Kenneth C.Smith, 6th Edition, Oxford International Student Edition

Programming for Problem Solving
Code: ESC203
Contact Hours: 3L
Credit: 2

Pre-Requisite:
1. Familiarity with the fundamentals of C
2. A solid background in mathematics, including probability, set theory.
3. Must have completed ESC181 for basic introduction to Python.

Course Outcome: -

1. To learn the basics of abstract data types.
2. To learn the principles of linear and nonlinear data structures.
3. To build an application using sorting and searching.
4. To understand why Python is a useful scripting language for developers.
5. To learn how to design and program Python applications.
6. To learn how to use lists, tuples, and dictionaries in Python programs.
7. To learn how to identify Python object types.

Topic:-

Module 1: Basics of C: Data types, Operators, Decision Control Structure
Module 2: Basics of C: Pointer, Dynamic memory Allocation-malloc, calloc, free, realloc
Module 3: Array: Array Definition & operations, 1D array, 2D array, Pointer and arrays, Array of Pointers
Module 4: Strings: String Operations, Array of Strings, Pointer and Strings
Module 5: Structure: Definition, self-referential structure, Array of structures, Structures & Functions
Module 6: Linked Lists: Linked List versus Arrays, Memory Allocation & De-allocation, Singly Linked List, Polynomial Representation, Circular Linked List
Module 7: Stack: Definition, Array and linked list implementation, Infix, Prefix, Post fix notation, Evaluation of infix expression, Infix to Postfix Expression conversion and evaluation, Application of Stack, Recursion
Module 8: Queue: Definition, Array and linked list implementation, Dequeue& Priority Queue (Concept only)
Module 9: Tree: Concept of Tree, Binary Tree, Expression Tree, Tree Traversal
Module 10:File Management Using C: Basic Operations Only
Module 11: Basics of Python: Datatypes, Constants, Variables, Operators & Expressions, Decision Statements
Module 12: Basics of Python Functions
Module 13: Basics of Python Strings: String in Python
Module 14: Basic Data structures using Python: List, tuple, Dictionary

Text Books:

1. " Programming in ANSI C", E. Balagurusamy, 6th Edition
2. " Data Structures Using C", ReemaThareja, 1st Edition
3. " Python Programming Using Problem Solving Approach", ReemaThareja, 1st Edition
4. "Think Python", Allen B Downey, 2nd Edition

English Communication and Public Speaking Skills-II
Code:HSMC201
Contact Hours: 2L
Credit: 2

Pre-Requisite: Basic knowledge of Grammar and English writing skills High school Standard

Course Outcome: -

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

Topics:-

Module 1: Fundamentals of Grammar & Vocabulary Building

a) The concept of Word Formation; Root words from foreign languages; Acquaintance with prefixes and suffixes; Synonyms, antonyms, and standard abbreviations
b) Introduction to Tense: Past, Present, Future
c) Narration and Reported Speech

Module 2: Modifiers and Determiners

a) Subject-Verb Agreement; Noun-Pronoun Agreement; Misplaced Modifiers
b) Articles Prepositions Conjunctions Modals Determiners**,** Clauses
c) Idioms and Phrasal Verbs Transformation of sentences

Module 3: Introduction to Technical Communication

a) Basics of Technical Communication, barriers to communication
b) Non-verbal Communication

Module 4: Listening

a) Active Listening, Effective Speaking
b) Conversations and Dialogues, Feedback

Module 5: Speaking

a) Interview skills including Cover Letter & CV formation
b) Group Communication/ Group discussion
c) Extempore

Module 6: Reading skill

a) Reading Comprehension
b) Reading Stories

Module 7: Writing Skills

a) Elements of Effective Writing, Art of Condensation, Sentence Structures & Types: Simple, Compound, Complex
b) Creating coherence: Arranging paragraphs & Sentences in logical order
c) Technical Reports, Formal Letters, Memos, and Email
d) Research Papers and Technical Descriptions; Précis Writing; Essay Writing; Business Letters; E-mail

Module 8: Formal Presentation

a) Introduction, Planning, Outlining and Structuring
b) Nuances of Delivery, Visual Aids in Presentations
c) Application of MS PowerPoint and slide presentation

Text Books:

1. Technical Communication Principles and Practice by Meenakshi Raman and Sangeeta Sharma. OUP.
2. English Grammar in Use; A self-study reference and Practice book or intermediate learners of English by Raymond Murphy; Cambridge Publications

English Communication and Public Speaking Skills-II Laboratory
Code:HSMC291
Contact Hours: 2L
Credit: 1

Pre-Requisite: Basic knowledge of Grammar and English writing skills High school Standard

Course Outcome: -

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

Topic:-

Module 1: Honing Listening skills through language lab audio device:

a) Listening to audio clips and renowned personalities
b) Listening to Speeches and evaluate them
c) Watching English movies and writing the synopsis and review

Module 2: Honing Reading Skills and its sub skills:

a) Reading fictional texts
b) Reading non/technical passage, graphics, diagrams etc.
c) Reading out their own piece of writing

Module 3: Honing Writing Skills:

a) Story writing
b) Writing Fiction
c) Framing Dialogues
d) Framing scripts
e) Essay Writing through clustering

Module 4: Role Play and Mock Interviews:

a) Hands on practice of dialogue writing and role play.
b) Introducing one before interview board

Module 5: Honing "Conversation Skills":

a) Face to face communication in work field
b) Telephonic Conversation with mobile phone.

Module 6: Helping them master linguistic/ paralinguistic features:

a) Proper Pronunciation
b) Voice modulation
c) Proper word stress, intonation, pitch and accent.
d) Perfect enunciation of speech

Module 7: Honing Speaking Skills:

a) JAM/ Extempore practice (Just a Minute).
b) Debate
c) Mock Interview
d) Video CV making
e) PPT presentation

Module 8: Introducing "Group Discussion":
a) Practice through audio-visual input and acquainting them with key strategies for success.
b) Teaching Leadership skills

Module 9: GD practice sessions for helping them internalize the basic principles:
a) Group Discussion on Current topics
b) Group Communication and necessary soft skills

Module 10: Introducing the skills of writing Papers (Research/ academic):
a) Paper writing manual
b) Writing a paper on communication

Text Books:
a) English Language Laboratories: A Comprehensive Manual by NiraKonar, PHI Publication, 2nd Edition
b) A Manual For English Language laboratory by D. Sudha Rani, Pearson Publication, 2011 Edition

Engineering Mechanics
Code: ESC204
Contact Hours: 3L
Credit: 3

Pre-Requisite: High School level Physics and Mathematics

Course Outcome:
1. Understand the application of force, couple and develop free body diagram of different arrangements.
2. Elaborate the theory of friction and understand the application of stress strain in truss member.
3. Understand the application of CG & MI.
4. Understand the concept of bending moment on beam and application of virtual work and energy method for rigid body.

Topic:-
Module 1: Force & Equilibrium Systems:
Basic concepts, ; Rigid Body equilibrium (2-D & 3-D); System of Forces, Coplanar Concurrent Forces, Components in Space – Resultant- Moment of Forces and its Application; Couples and Resultant of Force System, Equilibrium of System of Forces, Concept of Free body diagrams, Equations of Equilibrium of Coplanar Systems, Lami's Theorem, Vectors and tensors and their applications

Module 2: Friction:
Laws of Friction, Static and Dynamic Friction;, wedge friction and screw jack

Module 3: Basic Structural Analysis:
Equilibrium in three dimensions; Method of Sections; Method of Joints; How to determine if a member is in

tension or compression; Simple Trusses; Zero force members.

Module 4: Centre of Gravity & Moment of Inertia:
Centre of Gravity and its implications; Centroid of simple figures from first principle, centroid of composite sections; Area moment of inertia of plane sections from first principles, Theorems of moment of inertia, Moment of inertia of standard sections and composite sections; Concept of Mass moment inertia.

Module 5: Basic Concept of Bending Moment:
Transverse loading on beams, Concept of shear force and bending moment, Different type of beams and loading, relationships between shear force and bending moment, shear force and bending moment diagrams of point loading on cantilevers and simply supported beams

Module 6: Virtual Work and Energy Method:
Virtual displacements, principle of virtual work for rigid bodies, degrees of freedom. Mechanical efficiency, energy equation for equilibrium. Applications of energy method for equilibrium.

Text Books:

1. B B Ghosh, SatyajitChakrabarti, Samir Ghosh "Engineering Mechanics" S Chand Publisher.
2. J. L. Meriam, L. G. Kraige,J. N. Bolton "Engineering Mechanics: Statics", Wiley, 2011.
3. F. P. Beer and E. R. Johnston, Vector Mechanics for Engineers, Vol I – Statics. 9th Ed, Tata McGraw Hill
4. R. C. Hibbler (2006), Engineering Mechanics: Principles of Statics and Dynamics, Pearson Press
5. S. Timoshenko, D.H. Young, J.V. Rao, SukumarPati, Engineering Mechanics (In SI Units) (SIE).
6. M. F. Beatty, "Principles of Engineering Mechanics", Springer Science & Business Media, 1986.
7. Manoj K. Harbola, "Engineering Mechanics", Cengage Learning India Pvt. Ltd, 2018
8. D.S. Bedi& M.P. Poonia, "Engineering Mechanics", Khanna Publishing House, 2019
9. R.K. Bansal, "Engineering Mechanics", Laxmi Publications
10. Irving H. Shames (2006), Engineering Mechanics, 4th Edition, Prentice Hall
11. Shanes and Rao (2006), Engineering Mechanics, Pearson Education,
12. Tayal A.K. (2010), Engineering Mechanics, Umesh Publications

Essential Studies for Professionals – II
Code: HSMC202
Contact Hours: 2L
Credit: 2

Pre-Requisite: Fundamental knowledge of humanities; social science subjects till class 10th standard and knowledge of Economics up to class 11th standard.

Course Outcome: -

1. This part of the syllabus will create base of general knowledge among students which is required to appear in various competitive exams in public sector jobs (UPSC, SSC etc.).
2. It will inculcate their rights & duties to the society, it will help them to act according to law in society.
3. It will also improve basic banking knowledge among students.
4. Students can prepare various competitive exams and different placement aptitude test as well.

Topic:-

Module 1: Laws of Society:
History of Constitution, Preamble, Fundamental Rights, Directive Principle of State Policy and Fundamental Duties

Module 2: Our Ancient Past:
Indus Valley Civilization, Vedic Civilization, 16 Mahajanapadas, Mauryan Dynasty.

Module 3: Know Our Country:
Physiographic Division of India- Geological history of India, Northern Mountain, Mineral Resources of India.

Module 4: Financial Planning and Market Laws:
Basic Concept of Economics, National Income, Unemployment and Poverty

Module 5: India and World:
Monthly Current Affairs Magazine

Module 6: Universal Human Values:
Understanding Value Education, Method to fulfill the Basic Human Aspiration, Continuous happiness and Prosperity- the Basic Human Aspiration

Text Books:

1. Indian Constitution- M. Laxmikant
2. Indian Economy-Ramesh Singh
3. India's Ancient Past- R.S Sharma
4. Geography of India- Majid Hussain
5. Current Affairs Magazine of IEM-UEM

Programming for Problem Solving Laboratory
Code:ESC293
Contact Hours: 3L
Credit: 1

Pre-Requisite: ESC184

Course Outcome: -
To develop the programming skills of students know the principles of designing structured programs write basic C programs using the concepts of

1. Selection statements
2. Repetitive statements
3. Functions
4. Pointers
5. Arrays
6. Strings
7. Structures
8. Files
9. Introduction of Python

Topics:-

1. To learn the basics of array and pointers.
2. To learn the basics of abstract data types.
3. To learn the principles of linear and nonlinear data structures.
4. To learn the basics structure and its operation
5. To build an application using singly linked list , doubly linked list and circular linked list
6. To build an application using stack
7. To build an application using queue
8. To build an application using tree
9. To build an application using graph
10. To build an application using sorting and searching.
11. To understand why Python is a useful scripting language for developers.
12. To learn how to design and program Python applications.
13. To learn how to use lists, tuples, and dictionaries in Python programs.
14. To learn how to identify Python object types.

Text Books:

- Programming in ANSI C", E. Balagurusamy, 6th Edition
- Data Structures Using C", ReemaThareja, 1st Edition
- Python Programming Using Problem Solving Approach", ReemaThareja, 1st Edition
- "Think Python", Allen B Downey, 2nd Edition

Engineering Drawing, 3D Design Laboratory
Code: ESC294
Credit: 1
Contact Hours: 2L

Pre-Requisite: Concept of Geometry and Mathematics Knowledge of use of Drawing Instruments For learning AutoCAD, it is recommended that you have a working knowledge of: Microsoft Operating System like Windows 7, Windows 8 or Windows 10.

Course Outcome: -

1. Prepare students to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.
2. Prepare students to communicate effectively.
3. Prepare students to use the techniques, skills, and modern engineering tools necessary for engineering practice
4. Helping students to increase their visualization power

Topics:-
Module 1: INTRODUCTION TO ENGINEERING DRAWING:
Principles of Engineering Graphics and their significance, usage of Drawing instruments, lettering, Engineering Curves including Cycloid, Epicycloid, Hypocycloid and Involute; Scales – Plain, Diagonal

Module 2: ORTHOGRAPHIC PROJECTIONS:
Principles of Orthographic Projections-Conventions -Projections of Points and lines inclined to both planes;

Projections of planes inclined Planes -Auxiliary Planes;

Module 3: PROJECTIONS OF REGULAR SOLIDS:
Solids inclined to both the Planes- Auxiliary Views; Draw simple annotation, dimensioning and scale.

Module 4: SECTIONS AND SECTIONAL VIEWS OF RIGHT ANGULAR SOLIDS
Prism, Cylinder, Pyramid, Cone – Auxiliary Views; Development of surfaces of Right Regular Solids - Prism, Pyramid, Cylinder and Cone; Draw the sectional orthographic views of geometrical solids.

Module 5: ISOMETRIC PROJECTIONS
Principles of Isometric projection – Isometric Scale, Isometric Views, Conventions; Isometric Views of lines, Planes, Simple and compound Solids; Conversion of Isometric Views to Orthographic Views and Vice-versa, Conventions;

Module 6: OVERVIEW OF COMPUTER GRAPHICS
The computer technologies that impact on graphical communication, demonstrating knowledge of the theory of CAD software [such as: The Menu System, Toolbars (Standard, Object Properties, Draw, Modify and Dimension), Drawing Area (Background, Crosshairs, Coordinate System), Dialog boxes and windows, Shortcut menus (Button Bars), The Command Line (where applicable), The Status Bar, Different methods of zoom as used in CAD, Select and erase objects.;

Module 7: CUSTOMISATION & CAD DRAWING
Set up of the drawing page and the printer, including scale settings, setting up of units and drawing limits; ISO and ANSI standards for coordinate dimensioning and tolerancing; Orthographic constraints, Snap to objects manually and automatically; Producing drawings by using various coordinate input entry methods to draw straight lines, Applying various ways of drawing circles;

Module 8: ANNOTATIONS, LAYERING & OTHER FUNCTIONS
Applying dimensions to objects, applying annotations to drawings; Setting up and use of Layers, layers to create drawings, Create, edit and use customized layers; Changing line lengths through modifying existing lines (extend/lengthen); Printing documents to paper using the print command; orthographic projection techniques; Drawing sectional views of composite right regular geometric solids and project the true shape of the sectioned surface;

Text Books:

1. Pradeep Jain, AnkitaMaheswari, A.P. Gautam, Engineering Graphics & Design, Khanna Publishing House
2. Bhatt N.D., Panchal V.M. & Ingle P.R., (2014), Engineering Drawing, Charotar Publishing House
3. Agrawal B. &Agrawal C. M. (2012), Engineering Graphics, TMH Publication
4. Shah, M.B. & Rana B.C. (2008), Engineering Drawing and Computer Graphics, Pearson Education
5. Narayana, K.L. & P Kannaiah (2008), Text book on Engineering Drawing, Scitech Publishers
6. Corresponding set of CAD Software Theory and User Manual

Skill Development for Professionals – II
Code: HSMC282
Contact Hours: 2L
Credit: 1

Pre-Requisite: General Studies & current affairs Fundamental knowledge of humanities & social science subjects till class 10th standard and knowledge of Economics up to class 11th standard.

Course Outcome: -

1. Students will learn advance tricky approaches for solving Quant.
2. It will enhance student's skill to appear in various aptitude test within limited time constrain.
3. This module will enhance students' Analytical skill &will also improve quick decision-making skill.
4. Students can prepare various competitive exams and different placement aptitude test as well.

Topic:-

Module-1 Quantitative Aptitude

a. **Average**- Concept on average, different missing numbers in average estimation, shortcuts & their application.

b**. Mixture & Allegation** – Proportion & mixtures in percentages, populations & liquids, shortcuts & their application.

c. **Time & Work**- Basic concept, Chain rule, formulae & their application. Pipes & cistern.

d. **Time and distance** - Basic concept, Different problems & their shortcut tricks. Time & Speed & Tides- concept of speed, time & Distance, relative speed, Upstream & Downstream, formulae & their application.

Module-2 Logical Reasoning

1. **Cube** Dice, Miscellaneous Problems
2. **Data Sufficiency**
    - Problems on Blood Relation, ages, Numbers
    - Logical Test Based on Data Sufficiency
3. **Non-Verbal Reasoning**
    - Image Formation
    - Water –Images
    - Mirror Image
    - Image completion
    - Paper Cutting and Folding

Module-3 ObjectiveEnglish-2

- **Clauses**: Definition, Examples, Rules & Application, Types of Sentences (Simple +Complex +Compound) Examples, Rules & Application, Voice- Concept, Types, Examples, Rules & Application, Narration Change- Rules (Direct & Indirect Speech)
- **Vocabulary**-: Synonyms, Antonyms with examples, One word Substitution, Idioms
    - & Phrases
- **Spotting Errors**
- **Reading Comprehension** (Level II)

Module-4 Data Interpretation level-II

Newspaper reading: The Hindu & Economic Times

Text Books:

a) Fast Track Arithmetic- Rajesh Verma

b) Verbal & non-verbal reasoning- R.S Agarwal

c) Quantitative Aptitude- R.S Agarwal

d) Analytical Reasoning –Peeyush Bhardwaj

Foreign Language
Code: HSMC281
Contact Hours: 2L
Credit: 0.5

Pre-Requisite: None

Course Outcome: -

1. Improve performance in other academic areas.
2. Increase networking skills.
3. Provides better career choices.
4. Build up self-confidence.

Topic:-
Module 1:

Alphabet, Greetings, Use of accent, Use of Capital letter and Small letter, use of apostrophe, Articles, Gender, Singular & Plural, Partitive article, Cardinal Number, Days and Months, Date and Time, Ordinal Number, Personal Pronoun and Tonic Pronoun, Adjective (Descriptive, Demonstrative, Possessive), Position, Agreement of Adjective (For nationalities), Adverb, Preposition.

Text Books: None

Physical Education
Code: HSMC283
Contact Hours: 3L
Credit: 0.5

Pre-Requisite: None

Course Outcome: -

1. Develop motor abilities like strength, speed, endurance, coordination, flexibility, agility and balance, as they are important aspects for good performance in different games and sports.
2. Develop techniques and tactics involved in organized physical activities, games and sports.
3. Acquire knowledge about human body as its functioning is influenced by physical activities.
4. Understand the process of growth and development as participation in physical activities has positive relationship with it.
5. Develop socio-psychological aspects like control of emotions, balanced behavior, development of leadership and followership qualities and team spirit through participation in games and sports.
6. Develop positive health related fitness habits which can be practiced lifelong so as to prevent degenerative diseases.

Topic: -

YOGA THEORY

1. Benefits of Asana.
2. Importance of Meditation.

PRACTICAL: Asanas

1. **Standing Poses:**

   Utkatasana, Vrikshasana, Virabhadrasana, Garudasana, Tadasana, Natarajasana, Namaskara - Parsavakonasana, Hasta - Padangusthasana, Parivarta - ParsavakonasanaUtthito – Akopodopaschimottanasana

2. **Bending Poses:**

   Ardha - Chandrasana, Paschimottanasana, Ustrasana, Chakrasana, Padahastasana, Trikonasana, Sasangasana, Prasarita, Padottanasana, ArdhoBaddhaPadmotanasana, EkaPadaRajakapotasana.

Pranayama

Anilom-Vilom, Kapalbhati, Sheetkari, Bhastrika, Bhamri, Samavritti Pranayama

Meditation

Breathe Awareness Meditation
Mantra Meditation
Progressive Relaxation
Focused Meditation

KARATE-DO: THEORY

1. Karate as Sports in Olympic
2. World Karate Federation (WKF) Competition Fighting Rules (updated)
3. Scoring of Points during Competition

PRACTICAL: FITNESS EXERCISE: (JunbiTaiso):

1. Cardio-Vascular Exercise
2. Shoulder & Back Strengthen Exercise
3. Stomach & Lower Abdomen Exercise
4. Advance Stretching Exercises
5. Full Stretching

BASIC TECHNIQUES: (Kihon):

1. KARATE STANCE (Dachi)
   a) Backward Leaning Stance
   b) Cat Stance
   c) Crane Stance
   d) L-Stance & T-Stance
2. PUNCH (Zuki)
   a. Middle Finger Punch
   b) Back Fist Punch
   c) Front Punch
3. KICK (Geri)
   a) Side Kick
   b) Blade-Feet Kick
   c) Round Kick
4. BLOCK (Uke)
   a) Round Block
   b) Knife-Hand Block
   c) Crossed Hand Block
5. TECHNIQUE WITH MOVEMENT (IdoKihon)
   a) Punch with Movement

b) Kick with Movement
c) Combination of Punch – Kick – Block with Movement

6. FREE FIGHT (Kumite)
   Fight with using the basic techniques of Punch, Kick & Block

SPORTS & GAMES

Demonstration Practice of the skills, correction, involvement in game situation of following Sports:
i. Badminton, ii. Kabadi, iii. Volley Ball, iv. Hand Ball, v. Pool, and Others

Text Books: None

Design Thinking & Innovation- II
Code:MOOC202
Contact Hours: 2L
Credit:1

Pre-Requisite: None

Course Outcome: -

1. Examine Design Thinking concepts and principles
2. Practice the methods, processes, and tools of Design Thinking
3. Apply the Design Thinking approach and model to real world situations
4. Learn about Intellectual Property rights and how to file a Patent.

Topic:

Module -1: Product Innovation (4 Lectures)

a) Definition and Examples of Innovations (1 Lecture)
b) Levels of Innovations (1 Lecture)
c) Importance of Product Innovations (Uber, Ola, Netflix) (1 Lecture)
d) Phase of Design Thinking, Design Thinking principles that redefine business (1 Lecture)

Module-2: SCAMPER Technique (4 Lectures)

a) Introduction to Scamper Technique (1 Lecture)
b) Application of Substitute and Combine Technique for Design (1 Lecture)
c) Application of Adapt and Put to Other Use for Design (1 Lecture)
d) Application of Elimination and Rearrange/Reuse for Design (1 lecture)

Module-3: Introduction to IPR and Patent Filing (4 Lecture)

a) Introduction to Intellectual Property Rights (1 Lecture)
b) Various Type of IPR (1 Lecture)
c) Importance of Patent Filling (1 Lecture)
d) Process of Patent Filling in India (1 Lecture)

Text Books: None

Economics, Finance and Entrepreneurship Skills – II
Code: MOOC201
Contact Hours: 2L
Credit: 1.5

Pre-Requisite: Basic mathematics

Course Outcome: -

1. Upon completion of this laboratory course, students will be able to fabricate components with their own hands.
2. They will also get practical knowledge of the dimensional accuracies and dimensional tolerances possible with different manufacturing processes.
3. By assembling different components, they will be able to produce small devices of their interest

Topic:-

MODULE 1: CONCEPT OF NATIONAL INCOME

a) Understanding the working of an economy: Circular flow of Income
- Basic two sector model
- Three sector model with government
- Four sector open economy model with government

b) National Income (both market price and factor cost and only basic ideas)
- GDP
- GNP
- NDP
- NNP

c) Meaning of economic problems (only basic ideas)
  - Unemployment
  - Inflation

MODULE 2: MONEY & BANKING

a) Meaning of money
b) Functions of money
c) Types of money
d) Banking (types of banking)
e) Reserve bank of India (RBI)
   -Functions of RBI
f) Cash reserve ratio (CRR)
g) Bank rate
h) Repo rate
i) Reverse repo rate
j) Statutory liquidity ratio (SLR)

MODULE 3: Finance

a) Types of Finances
- Personal finance
- Corporate Finance
- Public/Government Finance

b) Importance of understanding financial fundamentals
- Importance of Financial Management
c) Functions of Financial Management

MODULE 4: Entrepreneurship

a) Different stages of an entrepreneurial venture
b) Life cycle of an Entrepreneurial Venture
c) Abridged case studies of successful entrepreneurs

Text Books:

a) Mankiw: Principles of Macroeconomics, Thomson
b) Krugman and Wells: Macroeconomics; Worth 2015
c) RuddarDutt, and KP.M. Sundaram. 71st edition – Indian Economy, S. Chand & Co, New Delhi, 2015
d) R. E. Caves, J. A. Frankel and R. W. Jones. World Trade and Payments: An Introduction, Pearson Education, 2007.
e) Financial Management BY Mazumder Ali and Nesha
f) Financial Management ByKar and Baghchi
g) Theory Of Entrepreneurship By Vasant Desai
h) Entrepreneurship By David H Holt

B.Tech 2nd Year 3rd Semester

Analog Electronic Circuits
Code: ESC301
Contact Hours: 3L
Credit: 3

Pre-Requisite:- Electrical technology, Semiconductor Devices, Basic electronics, Basic current and voltage technology, Engineering Mathematics

Course Outcome:

1. Acquire basic knowledge of physical and electrical conducting properties of semiconductors.
2. Develop the Ability to understand the design and working of BJT / FILTERS/RECTIFIER/OPERATIONAL AMPLIFIERS.
3. Able to design amplifier circuits using BJT / OPERATIONAL AMPLIFIERS and observe the amplitude and frequency responses of common amplifier circuits
4. Observe the effect of negative feedback on different parameters of an Amplifier and different types of negative feedback topologies.
5. Observe the effect of positive feedback and able to design and working of different Oscillators using BJTS.
6. Develop the skill to build, and troubleshoot Analog circuits.

Topic: -

Module-1:

1. Filters and Regulators: Capacitor filter, π-section filter, ripple factor, series and shunt voltage regulator, percentage regulation, 78xx and 79xx series, concept of SMPS.
2. Transistor Biasing and Stability: Q-point, Self-Bias-CE, Compensation techniques, h-model of transistors. Expression for voltage gain, current gain, input and output impedance, trans-resistance &trans-conductance; Emitter follower circuits, High frequency model of transistors.

Module -2:

1. Transistor Amplifiers: RC coupled amplifier, functions of all components, equivalent circuit, derivation of voltage gain, current gain, input impedance and output impedance, frequency response characteristics, lower and upper half frequencies, bandwidth, and concept of wide band amplifier.
2. Feedback Amplifiers & Oscillators: Feedback concept, negative & positive feedback, voltage/ current,series/shunt feedback, Berkhausen criterion, Colpitts, Hartley's, Phase shift, Wein bridge and crystal oscillators.

Module -3:

1. Operational Amplifier: Ideal OPAMP, Differential Amplifier, Constant current source (current mirror etc.), level shifter, CMRR, Open & Closed loop circuits, importance of feedback loop (positive &negative), inverting &noninverting amplifiers, voltage follower/buffer circuit.
2. Applications of Operational Amplifiers: adder, integrator & differentiator, comparator, Schmitt Trigger. Instrumentation Amplifier, Log & Anti-log amplifiers, Trans-conductance multiplier, Precision Rectifier, voltage to current and current to voltage converter, free running oscillator.

Module -4:

Multivibrator – Monostable, Bistable, A stable multivibrators; Monostable and a stable operation using 555 timer.

Text Books:

1. Microelectronic Circuit- Analysis & Design, Rashid, Cenage Learning.
2. Electronic Circuits: Discrete & Integrated, 3rd Edition, Schilling &Belove, McGraw Hill Company.
3. Electronic principles, 6th Edition, Malvino, McGraw Hill Company.
4. Operational Amplifier & Linear IC's, Bell, Oxford University Press.
5. 2000 Solved Problems in Electronics, Jimmie J. Cathey, McGraw Hill Inc.
6. Electronic Devices -System & Application, Robert Diffenderfer, Cengage Learning.
7. Op- Amps & Linear Integrated Circuits, Ravi Raj Dudeja& Mohan Dudeja, Umesh Publication

Analog Electronic Circuits Laboratory
Code: ESC391
Contact Hours:2L
Credit: 2

Pre-Requisite:- Electrical technology, Semiconductor Devices, Basic electronics, Basic current and voltage technology, Engineering Mathematics

Course Outcome:

1. Identify relevant information to supplement to the Analog Electronic Circuit.
2. Set up testing strategies and select proper instruments to evaluate performance characteristics of electronic circuit.
3. Choose testing and experimental procedures on different types of electronic circuit and analyze their operation different operating conditions.
4. Evaluate possible causes of discrepancy in practical experimental observations in comparison to theory.
5. Practice different types of wiring and instruments connections keeping in mind technical, Economical, safety issues.
6. Prepare professional quality textual and graphical presentations of laboratory data and Computational results, incorporating accepted data analysis and synthesis methods, Mathematical software and word-processing tools

Topic:-

Module-1: Study of Ripple and Regulation characteristics of full wave rectifier with and without capacitor filter.

Module-2: Study of Zener diode as voltage regulator.

Module-3: Construction of two stage R-C coupled amplifier & study of its gain and Bandwith.

Module-4: Realisation V-I & I-V converter using Operational Amplifier.

Module-5: Study of timer circuit using NE 555 and configuration of Monostable and A stable Multivibrator.

Module-6: Study of DAC & ADC

Module-7: Design of Combinational circuit for BCD to decimal conversion to drive 7-segment display using Multiplexer.

Module-8: Study of Inverting and Non Inverting Amplifier using Op-Amp

Module-9: Study of Voltage Adder Circuit using Op-Amp

Module-10: Study of Voltage Subtractor Using Op Amp

Text Books:

1. Microelectronic Circuit- Analysis & Design, Rashid, Cenage Learning.

2. Electronic Circuits: Discrete & Integrated, 3rd Edition, Schilling &Belove, McGraw Hill Company.
3. Electronic principles, 6th Edition, Malvino, McGraw Hill Company.
4. Operational Amplifier & Linear IC's, Bell, Oxford University Press.
5. 2000 Solved Problems in Electronics, Jimmie J. Cathey, McGraw Hill Inc.
6. Electronic Devices -System & Application, Robert Diffenderfer, Cengage Learning.
7. Op- Amps & Linear Integrated Circuits, Ravi Raj Dudeja& Mohan Dudeja, Umesh Publication

Data Structure & Algorithms
Code: PCC-CS301
Contact Hours:3L
Credit: 3

Pre-Requisite:- i) Basic programming knowledge of C and python.
ii) Basic mathematics knowledge like graph theory and set theory, indices, logarithms.

Course Outcome:

1. A student will learn all types of linear, non-linear data structures and their implementation using C and Python.
2. A student will learn to calculate time complexity and space complexity of any given algorithm.
3. A student must able to learn to apply data structure knowledge in the different subjects like Design and Analysis of Algorithms, Operating Systems, Database Management Systems, Artificial Intelligence & Machine Learning in upcoming semesters.

Topic:-

Module 1: Linear Data Structure:

Introduction: Why we need data structure? Concepts of data structures:

a) Data and data structure

b) Abstract Data Type and Data Type. Applications Algorithms and programs, basic idea of pseudo-code.

Algorithm efficiency and analysis, time and space analysis of algorithms – order notations.

Array: Different representations – row major, column major.Sparse matrix - its implementation and usage.Array representation of polynomials.

Linked List:Singly linked list, circular linked list, doubly linked list, linked list representation of polynomial and applications.

Stack and Queue:Stack and its implementations (using array, using linked list), applications.

Queue, circular queue, dequeue. Implementation of queue- both linear and circular (using array, using linked list), applications.

Recursion:Principles of recursion – use of stack, differences between recursion and iteration, tail recursion. Applications - The Tower of Hanoi.

Module 2: Nonlinear Data structures:

Trees: Basic terminologies, tree representation (using array, using linked list).

Binary trees - binary tree traversal (pre-, in-, post- order), recursive and non-recursive traversal algorithms of binary tree, threaded binary tree (left, right, full), and expression tree.

Binary search tree- operations (creation, insertion, deletion, searching).

Height balanced binary tree – AVL tree (insertion, deletion with examples only). B- Trees – operations (insertion, deletion with examples only).B+ Trees – operations (insertion, deletion with examples only).

Module 3: Graphs:

Graph definitions and concepts (directed/undirected graph, weighted/un-weighted edges, sub-graph, degree, cut vertex/ articulation point, pendant node, clique, complete graph, connected components – strongly connected component, weakly connected component, path, shortest path, and isomorphism). Graph representations/storage implementations – adjacency matrix, adjacency list, adjacency multi- list. Graph traversal and connectivity – Depth-first search (DFS), Breadth-first search (BFS) – concepts of edges used in

DFS and BFS (tree-edge, back-edge, cross-edge, forward-edge), applications.Minimal spanning tree Prim's algorithm (basic idea of greedy methods).

Module 4: Searching and Sorting:

a) **Sorting Algorithms:** Bubble sort and its optimizations, insertion sort, shell sort, selection sort, merge sort, quick sort, heap sort (concept of max heap, application – priority queue), radix sort.

b) **Searching:** Sequential search, binary search, interpolation search.

c) **Hashing:** Hashing functions, collision resolution techniques.

Text Books:

1. "Data Structures and Program Design In C", 2/E by Robert L. Kruse, Bruce P. Leung.
2. "Fundamentals of Data Structures of C" by Ellis Horowitz, SartajSahni, Susan Anderson-freed.
3. "Data Structures in C" by Aaron M. Tenenbaum.
4. **"**Data Structures" by S. Lipschutz.
5. "Data Structures Using C" by ReemaThareja.
6. "Data Structure Using C", 2/e by A.K. Rath, A. K. Jagadev.
7. **"**Introduction to Algorithms" by Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein.

Data Structure & Algorithms Laboratory
Code: PCC-CS391
Contact Hours:2L
Credit: 2

Pre-Requisite:- i) Basic programming knowledge of C and python.
ii) Basic mathematics knowledge like graph theory and set theory, indices, logarithms.

Course Outcome:

1. A student will learn all types of linear, non-linear data structures and their implementation using C and Python.
2. A student will learn to calculate time complexity and space complexity of any given algorithm.
3. A student must able to learn to apply data structure knowledge in the different subjects like Design and Analysis of Algorithms, Operating Systems, Database Management Systems, Artificial Intelligence & Machine Learning in upcoming semesters.

Topic:-

Module-1: Implementation of array operations: Stacks and Queues: adding, deleting elements Circular Queue: Adding & deleting elements Merging Problem: Evaluation of expressions operations on multiple stacks & queues.

Module-2: Implementation of linked lists: inserting, deleting, and inverting a linked list.

Module-3: Implementation of stacks & queues using linked lists, Polynomial addition

Module-4: Polynomial multiplication, Sparse Matrices: Multiplication, addition.
Module-5: Recursive and Non recursive traversal of Trees, Threaded binary tree, binary search tree.
Module-6: Application of sorting and searching algorithms.
Module-7: Hash tables implementation: searching, inserting and deleting, searching & sorting techniques.

Text Books:

1. "Data Structures and Program Design In C", 2/E by Robert L. Kruse, Bruce P. Leung.
2. "Fundamentals of Data Structures of C" by Ellis Horowitz, SartajSahni, Susan Anderson-freed.
3. "Data Structures in C" by Aaron M. Tenenbaum.
4. **"**Data Structures" by S. Lipschutz.
5. "Data Structures Using C" by ReemaThareja.
6. "Data Structure Using C", 2/e by A.K. Rath, A. K. Jagadev.
7. **"**Introduction to Algorithms" by Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein.

Digital Electronics
Code: ESC302
Contact Hours:3L
Credit: 3

Pre-Requisite:- Knowledge of Digital Electronics & Circuits

Course Outcome:

1. To develop an understanding of Digital electronic circuit components and their working principles.
2. To develop an understanding of different digital logic families and their applications.

Topic:-

Module 1:

Binary Number System & Boolean Algebra (recapitulation) BCD, ASCII, EBCDIC, Gray codes and their conversions

Signed binary number representation with 1's and 2's complement methods Binary arithmetic, Venn diagram, Boolean algebra (recapitulation) Representation in SOP and POS forms

Minimization of logic expressions by KMAP

Quine-McCluskey Minimization Technique (Tabular Method) Binary Number System & Boolean Algebra (recapitulation) BCD, ASCII, EBCDIC, Gray codes and their conversions

Signed binary number representation with 1's and 2's complement methods Binary arithmetic, Venn diagram, Boolean algebra (recapitulation) Representation in SOP and POS forms

Minimization of logic expressions by KMAP

Quine-McCluskey Minimization Technique (Tabular Method)

Module 2:

Combinational circuits - Adder and Subtractor circuits (half & full adder &subtractor) Encoder, Decoder, Comparator, Multiplexer, De-Multiplexer and Parity Generator

Module 3:

Sequential Circuits - Basic Flip-flop & Latch

Flip-flops -SR, JK, D, T and JK Master-slave Flip Flops Registers (SISO, SIPO, PIPO, PISO)

Ring counter, Johnson counter

Basic concept of Synchronous and Asynchronous counters (detail design of circuits excluded) Design of Mod N Counter

Module 4:

A/D and D/A conversion techniques – Basic concepts (D/A: R-2-R only A/D: successive approximation

Logic families- TTL, ECL, MOS and CMOS - basic concepts.

Text Books:

1. Digital Logic Design by Morris Mano - PHI
2. Digital Electronics by S. Salivahanan,S. Arivazhagan-OXFORD
3. Digital Electronics by P.Raja - Scitech Publications
4. Digital Fundamentals by Floyed& Jain -Pearson.
5. Microelectronics Engineering by Sedra& Smith-Oxford.
6. Principles of Electronic Devices & circuits by B L Thereja&Sedha, S Chand Digital Electronics, Kharate –Oxford

Digital Electronics Laboratory
Course Code: ESC392
Contact Hours:2L
Credit: 2

Pre-Requisite:- Knowledge of Digital Electronics & Circuits

Course Outcome:

1. To develop an understanding of Digital electronic circuit components and their working principles.
2. To develop an understanding of different digital logic gates and their applications hand on.

Topic:-

Module 1: Familiarity with basic gates ICs and Realization of NOT, AND, OR and XOR operations by using universal gates (both NAND and NOR). - Design some basic logic circuits using basic gates ICs.
Module 2: Design a circuit to indicate 4 bits odd and even numbers.
Module 3: Realization of a circuit to display prime and non-prime numbers (4 bit).
Module 4: Implementation of Half Adder. Implementation of Full Adder. Carryout expression is implemented by basic gates.
Module 5: Implementation of Full Adder by using 2 half Adders and an OR gate.
Module 6: Implementation of Half Subtractor.
Module 7: Implementation of Full Subtractor. Borrow out expression is implemented by basic gates.
Module 8: Implementation of Full Subtractor using 2 Half Subtractors and an OR gate.
Module 9: Realization of a circuit to convert BCD to Excess -3 codes.
Module 10: Realization of a circuit to convert Excess -3 codes to BCD.
Module 11: Design a circuit to convert 4 bit Binary to 4 bit Gray code.
Module 12: Design a circuit to convert 4 bit Gray code to 4 bit Binary.
Module 13: Realization of an Even Parity Generator and Checker circuit.
Module 14: Implementation of 2 bit comparator circuit.
Module 15: Realization of the internal architecture of 4:1 Multiplexer and 1:4 De-multiplexer.
Module 16: Implementation of Full Adder using MUX IC 4539B.
Module 17: Implementation of Full Subtractor using MUX IC 4539B.

Module 18: Realization of 4:2 Priority Encoder along with output indicator (basic gates).
Module 19: Realization of the internal architecture of 3:8 Decoder using basic gates.
Module 20: Realization of octal to binary encoder using basic gates.
Module 21: Implement Full Adder using IC 4008.
Module 22: Implement Full Subtractor using IC 4008.
Module 23: Truth table verification of SR flip-flop (using NAND gates only).
Module 24: Truth table verification of D flip-flop (using NAND gates only).
Module 25: Truth table verification of JK flip-flop (using NAND gates only).
Module 26: Truth table verification of T flip-flop (using NAND gates only).
Module 27: Design a Master slave flip-flop.
Module 28: Design 4-bit synchronous up counter.
Module 29: Design 4-bit synchronous down counter.
Module 30: Design 4-bit asynchronous up counter.
Module 31: Design 4-bit asynchronous down counter.
Module 32: Design a 3-bit synchronous up/down' counter using JK flip-flop with external mode signal M. If M=1, counter counts up and with M=0, counter counts down.
Module 33: Design and implement MOD-4 Ring counter.
Module 34: Design a Johnshon counter.
Module 35: Design a Decade counter.
Module36: Design an unit distance code counter.
Module 37: Realization of Serial-In-Parallel Out Shift register.
Module 38: Realization of Parallel-In-Parallel Out Shift register.
Module 39: Realization of Parallel-In-Serial Out Shift register.
Module 40: Realization of Bidirectional shift register (All using D flip-flops).

Text Books:

1. Digital Logic Design by Morris Mano – PHI
2. Digital Electronics by S. Salivahanan,S. Arivazhagan-OXFORD
3. Digital Electronics by P.Raja - Scitech Publications
4. Digital Fundamentals by Floyed& Jain -Pearson.
5. Microelectronics Engineering bySedra& Smith-Oxford.
6. Principles of Electronic Devices & circuits by B L Thereja&Sedha, S Chand Digital Electronics ,Kharate –Oxford

IT Workshop (Sci Lab/MATLAB/Python/R)
Code: PCC-CS302
Contact Hours:2L
Credit: 1

Pre-Requisite:- 1. Knowledge of Programming Logic
2. Experience with a high level language (C/C++,) is suggested.
3. Prior knowledge of a scripting language and Object-Oriented concepts is helpful but not mandatory.

Course Outcome:
1. Logic Building.
2. To master an understanding of problems and finding Solution.
3. Design real life problems and think creatively about solutions
4. Apply a solution in a program using R/Matlab/Python.
5. To be exposed to advanced applications of mathematics, engineering and natural sciences to program real life problems.

Topic:-

Module 1: Programming with Python

Introduction – History of the python, Features of the python, Installation guide, Basic Syntax, Concept of Variable, literals, Data Types, Operators.

Decision Control Structure & Loop Control Structure - If, If-Else, Forloop, While loop, Break, Continue, Pass.

Lists - Introduction, Accessing list, Different Operations, and Methods.

Tuple - Introduction, Accessing tuple, Different Operations, and Methods.

Dictionaries - Introduction, Accessing dictionaries, Different Operations, and Methods.

String Manipulation - Accessing Strings, Basic Operations, String slices, Function and Methods.

Functions - Defining a function, Calling a function, Argument passing, Anonymous function, Global and local variables.

Modules - Importing module, Math module, Random module, Packages, Composition, Input-Output Printing on screen, Reading data from keyboard, Opening and closing file, Reading and writing files.

Exception Handling - Exception, Exception Handling, Except clause, Try-finally clause, User Defined Exceptions.

Module 2: Programming in MATLAB

Introduction - Why MATLAB ?History, its strengths, Competitors, Starting MATLAB, Using MATLAB as a calculator, Quitting MATLAB.

Basics - Familiar with MATLAB windows, Basic Operations, MATLAB-Data types, Rules about variable names, Predefined variables.

Programming Concepts- Vector, Matrix, Array Addressing, Built-in functions, Mathematical Operations, Dealing with strings (Array of characters), Script file, Input commands, Output commands, Structure of function file, Inline functions, Feval command, Comparison between script file and function file.

Conditional Statements and Loop - Relational and Logical Operators, If-else statements, Switch-case statements, For loop, While loop, Special commands (Break and continue), Import data from large database, Export data to own file or database.

2D and 3D Plotting - In-built functions for plotting, Multiple plotting with special graphics, Curve fitting, Interpolation, Basic fitting interface, use of meshgrid function, Mesh plot, Surface plot, Plots with special graphics.

Module 3: AR-VR Programming & UNITY Programming

AR-VR Programming -History and differences between Augmented and Virtual Reality, Basics of Computer Vision and Multimodal Interaction, AR systems for Fault Inspection, Digital Twin, Virtual Reality System development in Unity, Rendering real time sensor data in VR model, Building Augmented Reality application.

Unity Programming -Game Engines, Unity Development Environment, C# scripting concepts, 2D game physics, Data types, variables and math, Logical expressions and flow control, Sprites and Unity game components, Debugging and exceptions, Object-Oriented Programming, Loops and Arrays, Game design strategies, Animation and sound effects.

Module 4: Android App Development

Introduction - What is Android?, First Android app, How to run and debug applications? (Emulator vs. Real device), Android project structure, XML files, Enhancing the first app.

Basics - Activity, Menus, Intents, Context.

Variables and Operators - Variables, Arithmetic operators, Relational operators, Logical operators.

Object Oriented Programming - Collections in Java, Static keyword, Interfaces and Abstract classes,

Exceptions.

Android capabilities -intelliJIDEA / Android Studio, Permissions, Images, Layout, Working with files, Working with the network, Debugging Android apps, Providing feedback to the user (Vibration, Sounds, Flash), Raw camera usage, Touch gestures, Location, Status bar notifications, Localization, Services.

Module 5: Web Technology & Multimedia

HTML - History of HTML, HTML Tags, Attributes and Elements, HTML Basic Tags, HTML Formatting Tags, HTML Color Coding, HTML images, hyper link, form, table.

CSS - CSS Syntax, External Style Sheet using <link>, single Style Sheet, Multiple Style Sheets, ID Selectors and Class Selectors.

Scripting Language - Java Script, Angular JS.

PHP - Static webpage designing.

Multimedia - Image - Formats, Image Color Scheme, Image Enhancement.

Video - Analogue and Digital Video, Recording Formats and Standards (JPEG, MPEG, H.261) Transmission of Video Signals and Video Capture.

Text Books:

1. **MATLAB Programming for Engineers, 6E-**Author(s): Stephen J. Chapman, ISBN: 9789353502874, Cengage Learning India Private Limited, Noida
2. **Mastering MATLAB 7,**-Author(s): Duane C. Hanselman, Bruce Littlefield, ISBN: 9788131707432, Pearson Education India Pvt. Ltd.
3. The Fourth Transformation: How Augmented Reality & Artificial Intelligence Will Change Everything, CreateSpace Independent Publishing Platform; 1st edition ISBN 10: 1539894444.
4. Grigore C. Burdea, Philippe Coiffet , Virtual Reality Technology, Wiley 2016.
5. Dieter Schmalstieg and Tobias Höllerer, Augmented Reality: Principles & Practice, Pearson Education India, 2016.
6. A Text Book of IT Workshop on Python Programming (NSEC, WB). Author: Das/Patra.
7. Fundamentals of Python: First Programs with MindTap. Author: Lambert.
8. Headfirst Android Development.

IT Workshop Practical (Sci Lab/MATLAB/Python/R)

Code: PCC-CS392

Contact Hours:2L

Credit: 2

Pre-Requisite:- 1. Knowledge of Programming Logic

2. Experience with a high level language (C/C++,) is suggested.
3. Prior knowledge of a scripting language and Object-Oriented concepts is helpful but not mandatory.

Course Outcome:

1. Logic Building.
2. To master an understanding of problems and finding Solution.
3. Design real life problems and think creatively about solutions
4. Apply a solution in a program using R/Matlab/Python.
5. To be exposed to advanced applications of mathematics, engineering and natural sciences to program real life problems.

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Modules - Importing module, Math module, Random module, Packages, Composition, Input-Output Printing on screen, Reading data from keyboard, Opening and closing file, Reading and writing files.

Exception Handling - Exception, Exception Handling, Except clause, Try-finally clause, User Defined Exceptions.

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Basics - Activity, Menus, Intents, Context.

Variables and Operators - Variables, Arithmetic operators, Relational operators, Logical operators.

Object Oriented Programming - Collections in Java, Static keyword, Interfaces and Abstract classes, Exceptions.

Android capabilities -intelliJIDEA / Android Studio, Permissions, Images, Layout, Working with files,

Working with the network, Debugging Android apps, Providing feedback to the user (Vibration, Sounds, Flash), Raw camera usage, Touch gestures, Location, Status bar notifications, Localization, Services.

Module 5: Web Technology & Multimedia

HTML - History of HTML, HTML Tags, Attributes and Elements, HTML Basic Tags, HTML Formatting Tags, HTML Color Coding, HTML images, hyper link, form, table.

CSS - CSS Syntax, External Style Sheet using <link>, single Style Sheet, Multiple Style Sheets, ID Selectors and Class Selectors.

Scripting Language - Java Script, Angular JS.

PHP - Static webpage designing.

Multimedia - Image - Formats, Image Color Scheme, Image Enhancement.

Video - Analogue and Digital Video, Recording Formats and Standards (JPEG, MPEG, H.261) Transmission of Video Signals and Video Capture.

Text Books:

1. **MATLAB Programming for Engineers, 6E-**Author(s): Stephen J. Chapman, ISBN: 9789353502874, Cengage Learning India Private Limited, Noida
2. **Mastering MATLAB 7,**-Author(s): Duane C. Hanselman, Bruce Littlefield, ISBN: 9788131707432, Pearson Education India Pvt. Ltd.
3. The Fourth Transformation: How Augmented Reality & Artificial Intelligence Will Change Everything, CreateSpace Independent Publishing Platform; 1st edition ISBN 10: 1539894444.
4. Grigore C. Burdea, Philippe Coiffet , Virtual Reality Technology, Wiley 2016.
5. Dieter Schmalstieg and Tobias Höllerer, Augmented Reality: Principles & Practice, Pearson Education India, 2016.
6. A Text Book of IT Workshop on Python Programming (NSEC, WB). Author: Das/Patra.

Mathematics-III (Differential Calculus, Probability, Statistics)

Course Code: BSC301

Contact Hours:2L

Credit: 2

Pre-Requisite:- High School Mathematics, Concepts of Probability theory

Course Outcome:

1. Use discrete and continuous probability distributions , mean and variance, and making decisions
2. Learn bivariate distributions and properties
3. Calculate and interpret the correlation between two variables, calculate the simple linear regression equation for a set of data, Know the association between the attributes.
4. Know the construction of point and interval estimators and the process of estimating a parameter.
5. State appropriate null and alternative hypotheses , state the relationship between a CI for □ and a test about □ (one or two sided) also about s.d.
6. Perform a hypothesis test and state conclusion with a sentence.

Topic:-

MODULE I

Random variable, Discreterandom variables, Probability Mass Function, Distribution Function, Binomial, Poisson, Binomial approximation to the Poisson distribution,

Continuous random variables and their properties, distribution functions and densities, Uniform, Normal,

Exponential and Gamma densities.
Expectation, Moments of random variables, Transformation of Random variables, Chebyshev'sInequality.

MODULE II

a) Bivariate Probability Distributions and their properties (discrete&continuous), marginal distribution, distribution of sums and quotients, conditionaldensities&independence, relatedproblems.
b) Concept of Regression, Correlation Coefficient, RegressionLines, Properties of Regression coefficients, Principle of Least Squares, Method of fitting a straight line & a parabola to a given set of observations, related Problems.

MODULE III

a) SamplingTheory :Randomsampling (SRSWR & SRSWOR), parameter, stastistic and itssampling distribution, Standard error of statistic, Sampling distribution of samplemean& variance in randomsamplingfrom a normal distribution (statementonly), relatedproblems.
b) Statistical Inference: Estimation of parameters, Unbiased& Consistent estimators, Point &Interval estimations, Maximum likelihood estimation of parameters (Binomial, Poisson, & Normal),Confidence intervals, related problems.
c) Testing of Hypotheses: Itsdefinition-Null& Alternative Hypothesis, Critical Region, Level of significance, Type I and Type II errors, Best CriticalRegion, related problems, Large sample tests: Large sample test for single mean, difference of means, single proportion, difference of proportions, standard deviations, Small sample tests: Small sample test for single mean, difference of means, Test for ratio of variances, Chi-square test for goodness of fit &independence of attributes.

Text Books:

1. S. Ross, A First Course in Probability, 6th Ed., Pearson Education India, 2002.
2. Miller &Freund's, Probability and Statistics for Engineers, Pearson Education.
3. Spiegel M R., Schiller J.J. and Srinivasan R.A.: Probability and Statistics (Schaum'sOutlineSeries), TMH
4. Gupta &Kapoor, Fundamentals of Mathematical Statistics, Sultan Chand & Sons 55 5. John E. Freund, Ronald E. Walpole, Mathematical Statistics, Prentice Hall.

Humanities – I (Technical Report Writing using Latex)
Code: HSMC301
Contact Hours:3L
Credit: 3

Pre-Requisite: -

1. The students must have basic command of English to talk about day- to-day events and experiences of life.
2. Comprehend Lectures delivered in English, read and understand relevant materials written in English, write grammatically correct English

Course Outcome:

1. To expose the students in the fields of emerging technologies.
2. The students will develop a basic understanding of how to make a documentary or how to work with the designing techniques.
3. It will emphasize the learners and researchers to create a professional quality, typeset publication for

their postgraduate project reports, writing scientific and technical papers.

4. By the end of the course, the participants will be confident enough to typeset their documents using LATEX

Topic:-

Module 1: Basics of Technical Report Writing

1. Defining the term 'technical report' and likewise emphasizing the importance of drafting technical reports in engineering fields.
2. Locating the 'problem statement' as a pre-requisite criterion for drafting a technical report.
3. Drafting the report per accordance to the required format of the multifarious technical report style-article, journal, research publications, book formats etc.

Module 2: Structural Layout of a Technical Report

1. The technical report is divided and subdivided into chapters, parts and sections strictly adhering to the norms of a formal technical report.
2. Elaborating on the structural divisions/ sub divisions of the technical report, thereby stating the functional importance of each of the parts w.r.t the drafting of a technical report.

Module 3: Basic Concerns of textformatting in a Technical Report

1. Sectioning chapters per requirement of the technical document.
2. Using of graphic details for data representation.
3. List of references/ end notes/foot-notes
4. Specialcharacters
5. Bibliography andcitations

Module 4: LaTeX installation for typesetting a Technical Report.

1. Introduction toLaTeX
2. The benefits of using LaTeX for typesetting a technical document.
3. Required Components of a LaTeXDocument
4. Typing LaTeXCommands

Module 5:Drafting of Technical Reports using LaTeX as a technical tool.

1. Drafting of technical reports using LaTeX as a technical tool.
2. Group presentation of the technical reports through beamerclass

Text Books: None

Universal Human Values – III

Code: HSMC302

Contact Hours:3L

Credit: 3

Pre-Requisite:- Fundamental knowledge of humanities & social science subjects till class 10th standard and knowledge of Economics up to class 11th standard.

Course Outcome:

1. The Course will give a holistic approach towards learning engineering.
2. It will encourage multi-disciplinary thoughts among budding engineers and make them more responsible citizens.
3. Students will get sensitized their students towards larger socio-economic, human, environmental and geographical concerns.

Topic:-

Module 1: Laws of Society:

Union Executive- President, Vice President, PM and Council of Ministers, Attorney General

Module 2: Our Freedom Struggle:

Arrival of the Europeans- Portuguese, Dutch, English, French; Land Revenue System, Economic Exploitation of British Rule, Socio-religious Reforms Movement.

Module 3: Know Our Country:

Physical Geography of India- Peninsular Plateau, Northern Great Plains, Coastal Plains, Soil of India.

Module 4: RBI and Banking:

Banking System of India with reference to RBI, Capital Market

Module 5: India and World:

Monthly Current Affairs Magazine

Module 6: Universal Human Values:

Understanding Human Beings as the co-existence of the self and the body, Program to ensure self regulation and health, Understanding harmony in the nature.

Text Books: None

Course Title: Mandatory Additional Requirements (MAR)
Course Code: MC381
Credit: 0

Course Title: Innovative Project – I
Course Code: PROJ-CS301
Contact Hours:2L
Credit: 1

Course Title: Massive Open Online Courses (Mandatory for B.Tech (Honours))
Course Code: MOOC 3
Credit: 1

B.Tech 2nd Year 4thSemester

Discrete Mathematics
Code: PCC-CS401
Contact Hours:4L
Credit: 4

Pre-Requisite: -Secondary level Mathematics concepts.

Course Outcome:

1. Use logical notation & Perform logical proofs
2. Apply recursive functions and solve recurrence relations
3. Determine equivalent logic expressions
4. Apply deterministic and nondeterministic automata models
5. Apply basic and advanced principles of counting
6. Define sets and sequences

Topic: -

Module1: Propositional Logic:
Logical Connectives, Conjunction, Disjunction, Negation and their truth table. Conditional Connectives, Implication, Converse, Contra positive, Inverse, Bi-conditional statements with truth table, Logical Equivalence, Tautology, Normal forms-CNF, DNF; Predicates and Logical Quantifications of propositions and related examples.

Module 2: Theory of Numbers:
Well Ordering Principle, Divisibility theory and properties of divisibility; Fundamental theorem of Arithmetic;
EuclideanAlgorithmforfindingG.C.DandsomebasicpropertiesofG.C.Dwith simple examples; Congruences, Residue classes of integer rmodulo ()nnZandits examples;

Module 3: Order,RelationandLattices:
POSET,HasseDiagram,Minimal,Maximal,GreatestandLeastelementsinaPOSET,Latticesanditsproperties,PrincipleofDuality,DistributiveandComplementedLattices.

Module4:CountingTechniques:
Permutations, Combinations, Binomial coefficients, Pigeon- hole Principle, Principles of inclusion andexclusions; Generating functions, Recurrence Relations and their solutions using generating function,RecurrencerelationofFibonaccinumbersanditssolution,Divide-and-Conqueralgorithmanditsrecurrencerelationanditssimpleapplicationincomputer.

Module 5:GraphColoring:
ChromaticNumbersanditsbounds,IndependenceandCliqueNumbers,PerfectGraphs-Definitionandexamples,Chromaticpolynomialanditsdetermination,ApplicationsofGraphColoring.

Module6:Matchings:
DefinitionsandExamplesofPerfectMatching,MaximalandMaximumMatching,Hall'sMarriage Theorem (Statement only)andrelatedproblems.

Text Books:

1. KennethH.Rosen,DiscreteMathematicsandItsApplications,McGrawHill.

2. RussellMerris,Combinatorics,WILEY-INTERSCIENCE SERIESINDISCRETEMATHEMATICSANDOPTIMIZATION
3. N.Chandrasekaranand, M.Umaparvathi,DiscreteMathematics, PHI
4. GaryHaggard,JohnSchlipfandSueWhitesides,DiscreteMathematicsforComputerScience,CENGAGELearning.
5. GaryChartrandandPing Zhang–IntroductiontoGraphTheory,TMH

Computer Organization & Architecture

Code: PCC-CS402

Contact Hours:2L

Credit: 3

Pre-Requisite: -Basic Electronics Engineering Fundamentals of computers, Introduction to programming, Basicnumber systems, Binary Arithmetic, Digital Electronics Minimization of logical expression using different logicgates,Detail discussion about combinationaland sequential circuits

Course Outcome:

1. To develop ability to design parallel processor.
2. To develop ability to design the mechanism by which the performance of the system is enhanced.
3. To understand memory technology.
4. To understand the communication among processing elements.

Topic: -

Module1:

- Introductiontocomputer organization &architecture
- Basicorganizationofthestoredprogramcomputerandoperationsequenceforexecutionofaprogram.Roleofoperatingsystemsandcompiler/assembler.
- Fetch,decodeandexecutecycle,Conceptofoperator,operand,registersandstorage,Instructionformat.Instructionsets andaddressingmodes
- Quantitativetechniquesincomputerdesign-Part1
- IntroductiontoRISCarchitectures.RISCvsCISCarchitectures

Module2:

- Commonlyusednumber systems. Fixedand floating-point representationofnumbers;ConceptofOverflowandUnderflow.
- Design ofadders-ripplecarryandcarrylook-aheadprinciples.
- Fixedpointmultiplication –UnsignedandSigned -Booth'salgorithm.
- Fixedpointdivision –Restoringandnon-restoringalgorithms.
- Floatingpoint-IEEE754 standard.
- Designof ALU.
- Design ofcontrolunit- hardwiredandmicroprogrammedcontrol
- IntroductiontoVon-Neumann &HarvardArchitecture.

Module 3:

a. Memory organization, static and dynamic memory, memory hierarchy, associative memory.
b. Hierarchical memory technology: Inclusion, Coherence and locality properties
c. Cache memory organizations, Techniques for reducing cache misses;

d. Virtual memory organization, mapping and management techniques, memory replacement policies.
e. Memory unit design with special emphasis on implementation of CPU-memory interfacing. Data path design for read/write access.
f. I/O operations - Concept of handshaking, Polled I/O, interrupt and DMA

Module 4:

a. Quantitative techniques in computer design - Part2
b. Pipelining: Basic concepts, instruction and arithmetic pipeline, data hazards, control hazards and structural hazards, techniques for handling hazards.
c. Pipeline optimization techniques, Compiler techniques for improving performance.
d. Instruction-level parallelism: basic concepts, techniques for increasing ILP, superscalar, super pipelined architectures. Array and vector processors.

Module 5:

a. Multiprocessor architecture: taxonomy of parallel architectures - Introduction to Flynn's Classification; Centralized shared - memory architecture: synchronization, memory consistency, interconnection networks. Distributed shared memory architecture.
b. Non von-Neumann architectures - Data flow computers.

Text Books:

1. ComputerOrganizationandArchitecture:DesigningforPerformance,WilliamStallings, Prentice-Hall India
2. ComputerOrganization,CarlHamacher,ZvonkoVranesicandSafwatZaky,TataMcGrawHill
3. ComputerArchitectureAQuantitativeApproach,JohnLHennessyandDavidPatterson,MorganKaufman
4. StructuredComputerOrganization,AndrewS.Tanenbaum,Prentice-HallIndia
5. ComputerArchitecture&ParallelProcessing. Kai Hwang&Briggs,TataMcGrawHill
6. ComputerSystemArchitecture,M.M. Mano,PHI.
7. ComputerOrganization&Architecture, PNBasu, VikasPublication

Computer Organization & Architecture Laboratory

Code: PCC-CS492
Contact Hours:2L
Credit: 2

Pre-Requisite: -Basic Electronics Engineering Fundamentals of computers, Introduction to programming, Basicnumber systems, Binary Arithmetic, Digital Electronics Minimization of logical expression using different logicgates,Detail discussion about combinational and sequential circuits

Course Outcome:

1. To develop ability to design the mechanism by which the performance of the system can be enhanced.
2. To understand memory storage & connections.
3. To understand the communication among processing elements inside the computer architecture.
4. To understand how to simulate the electronic circuits and measure their functionalities.

Topic: -

1. Design a 3 bit carry save adder circuit
2. Design a 2 bit Serial adder circuit
3. Design a 3 bit Carry skip adder
4. Design a 3 bit Manchester chain adder
5. Design a 3 bit Carry select adders
6. Design a 3 bit Pre-Fix Adders
7. Design a 3 bit Multi-operand adder
8. Design a 3 bit Pipelined parallel adder
9. Design a circuit to construct a n-bit common bus using 4 n-bit registers and n no. of MUX each of 4×1
10. Design a circuit to construct a 2-bit common bus using Tri state buffer and decoder
11. Design a circuit to construct a 4-bit binary Incremental unit
12. Design a circuit to construct a 4-bit binary Decrementor unit
13. Design a circuit to construct a 3-bit combinational shifter unit
14. Design a circuit to construct a 16bit processor composed 4 4-bit slices
15. Design a 4×4 array multiplier to perform multiplication of 2 unsigned integer
16. Design a digital circuit to perform Sequential multiplication method for unsigned integer
17. Design a digital circuit to perform Booth's multiplication procedure for signed number
18. Design a digital circuit to perform Restoring division method based on 2 unsigned integer
19. Design a digital circuit to perform Non-restoring division method based on 2 unsigned integer
20. Design a single error detecting and correcting circuit using hamming code approach
21. Design a Multiplier control unit by using hardwired control design approach
22. Design a control unit by using multi-program control design approach
23. Design a micro program sequencer unit
24. Design a 16-bit CPA using 4-bit CPA
25. HDL introduction
26. Basic digital logic base programming with HDL
27. 8-bit Addition, Multiplication, Division
28. 8-bit Register design
29. Memory unit design and perform memory operations.
30. 8-bit simple ALU design
31. 8-bit simple CPU design
32. Interfacing of CPU and Memory

TextBooks:

1. ComputerOrganizationandArchitecture:DesigningforPerformance,WilliamStallings, Prentice-Hall India
2. ComputerOrganization,CarlHamacher,ZvonkoVranesicandSafwatZaky,TataMcGrawHill
3. ComputerArchitectureAQuantitativeApproach,JohnLHennessyandDavidPatterson,MorganKaufman
4. StructuredComputerOrganization,AndrewS. Tanenbaum,Prentice-HallIndia
5. ComputerArchitecture&ParallelProcessing. Kai Hwang&Briggs,TataMcGrawHill
6. ComputerSystemArchitecture,M.M. Mano,PHI.

Operating Systems

Code: PCC-CS403

Contact Hours:2L

Credit: 3

Pre-Requisite: -

- Basic idea about hardware and software.
- Basic idea about steps of instruction execution.
- Basic knowledge of programming and data structure & algorithm.

Co-Requisite: Computer Organization & Architecture.

Course Outcome:

1.A student will learn about structure and use of different types of operating systems.

2.A student will learn how hard disk is being partitioned.

3.A student will learn how computer starts (booting).

4.A student will learn how computer operates at each event.

5.A student will learn how operating system is giving protection to all the stored data and procedure.

Topic: -

Module 1: Introduction to OS. Operating system functions, evaluation of O.S., Different types of O.S.: batch, multi-programmed, time-sharing, real-time, distributed, parallel.

Module 2: Computer system operation, I/O structure, storage structure, storage hierarchy, different types of protections, operating system structure (simple, layered, virtual machine), O/S services, system calls.

Module 3: Processes: Concept of processes, process scheduling, operations on processes, co-operating processes, inter-process communication.

Module 4: Threads: Overview, benefits of threads, user and kernel threads.

Module 5: CPU scheduling: scheduling criteria, preemptive & non-preemptive scheduling, scheduling algorithms (FCFS, SJF, RR, priority), algorithm evaluation, multi-processor scheduling.

Module 6: Process Synchronization: background, critical section problem, critical region, synchronization hardware, classical problems of synchronization, semaphores.

Module 7: Deadlocks: system model, deadlock characterization, methods for handling deadlocks, deadlock prevention, deadlock avoidance, deadlock detection, recovery from deadlock.

Module 8: Memory Management: background, logical vs. physical address space, swapping, contiguous memory allocation, paging, segmentation, segmentation with paging.

Module 9: Virtual Memory: background, demand paging, performance, page replacement, page replacement algorithms (FCFS, LRU), allocation of frames, thrashing.

Module 10: File Systems: file concept, access methods, directory structure, file system structure, allocation methods (contiguous, linked, indexed), free-space management (bit vector, linked list, grouping), directory implementation (linear list, hash table), efficiency & performance.

Module 11: I/O Management: I/O hardware, polling, interrupts, DMA, application I/O interface (block and character devices, network devices, clocks and timers, blocking and non-blocking I/O), kernel I/O subsystem (scheduling, buffering, caching, spooling and device reservation, error handling), performance.

Module 12: Disk Management [4L]: disk structure, disk scheduling (FCFS, SSTF, SCAN,C-SCAN) , disk reliability, disk formatting, boot block, bad blocks.

Module 13: Goals of protection, domain of protection, security problem, authentication, one time password, program threats, system threats, threat monitoring, encryption.

TextBooks:

1. MilenkovieM., "OperatingSystem:Concept&Design", McGraHill.
2. TanenbaumA.S., "OperatingSystemDesign& Implementation", Practice HallNJ.
3. SilbersehatzA.andPeterson J.L., "OperatingSystem Concepts", Wiley.
4. Dhamdhere:OperatingSystemTMH
5. Stalling,William,"OperatingSystems",MaxwellMcMillanInternationalEditions,1992.
6. DietelH. N.,"AnIntroductiontoOperatingSystems", AddisonWesley

Operating Systems Laboratory

Code: PCC-CS493

Contact Hours:2L

Credit: 2

Pre-Requisite: - i. Basic idea about hardware and software.
ii.Basic idea about steps of instruction execution.
iii. Basic knowledge of programming and data structure & algorithm.

Co-Requisite: ComputerOrganization&Architecture.

Course Outcome:

1. To develop conceptual understanding of Unix commands and various filters
2. To implement various operating system concepts through programming (such as, Process, Scheduling etc.).
3. To develop understanding about shell Programming and AWK scripting
4. To develop skill to solve various unix system administration problems with the application of shell programming

Topic:-

Module1:Shellprogramming:creating script,makingascriptexecutable,shellsyntax(variables,conditions, conditions, control structures, functions, commands).
Module 2: Process: starting new process, replacing a process image, duplicating a process image, waiting for a process, zombie process.
Module 3: Signal: signal handling, sending signals, signal interface, signal sets.
Module 4: Semaphore: programming with semaphores (use functions semctl, semget, semop, set_semvalue, del_semvalue, semaphore_p, semaphore_v).
Module 5: POSIX Threads: programming with pthreadfunctions(viz. pthread_create, pthread_join, pthread_exit, pthread_attr_init, pthread_cancel)
Module6:Inter-process communication: pipes(use functions pipe, popen, pclose),named pipes(FIFOs, accessing FIFO)

TextBooks:

1. "UNIX – Concepts and Applications", Sumitabha Das, 4th Edition, Tata McGraw.
2. MilenkovieM.,"OperatingSystem:Concept&Design", McGrawHill.
3. TanenbaumA.S.,"OperatingSystemDesign&Implementation",PracticeHallNJ.
4. SilbersehatzA.andPetersonJ.L.,"OperatingSystemConcepts",Wiley.
5. Dhamdhere:OperatingSystemTMH
6. Stalling,William,"OperatingSystems",MaxwellMcMillanInternationalEditions,1992.
7. DietelH. N.,"AnIntroductiontoOperatingSystems", AddisonWesley

Design & Analysis of Algorithms

Code: PCC-CS404

Contact Hours:2L

Credit: 3

Pre-Requisite: -PCC-CS301, Data Structure and Algorithm

Course Outcome:

1. Reinforce basic design concepts (e.g., pseudo code, specifications, top-down design)
2. Knowledge of algorithm design strategies
3. Familiarity with an assortment of important algorithms
4. Ability to analyze time and space complexity

Topic:-

Module 1: Introduction: Characteristics of algorithm. Analysis of algorithm: Asymptotic analysis ofcomplexitybounds–best,averageand worst-case behavior;PerformancemeasurementsofAlgorithm,Time and space trade-offs, Analysis of recursive algorithms through recurrence relations: Substitution method, Recursion tree method and Master's theorem; Divide and Conquer algorithms – Merge Sort, Quick Sort, finding lower bound of comparison-based sorting algorithms, Strassen's algorithm for multiplying matrices.

Module2: Fundamental Algorithmic Strategies: Brute-force, Greedy, Dynamic Programming, Branch and Bound and Backtracking methodologies for the design of algorithms; Illustrations of these techniques for Problem solving, Bin Packing, Knapsack, TSP, Heuristics – characteristics and their application domains, KMP algorithm.

Module 3: Graph and Tree Algorithms: Traversal algorithms:Depth First Search(DFS) and Breadth First Search (BFS), Disjoint Set Data Structures, Shortest paths algorithms, Minimum Spanning Tree, Topological sorting, Network Flow Problem.

Module 4: Tractable and Intractable Problems: Computability of Algorithms, Computability classes– P,NP, NP-complete and NP-hard, Cook's theorem, Standard NP-complete problems and Reduction techniques.

Module 5: Advanced Topics: Approximation algorithms, Randomized algorithms, Class of problems beyond NP –P SPACE.

Text Books:

1. Introduction to Algorithms,4th Edition,ThomasHCormen,CharlesELieserson, Ronald LRivestandCliffordStein,MITPress/McGraw-Hill.
2. Algorithms, 4th Edition,RobertSedgewickandKevinWayne,PrincetonUniversity.
3. Fundamental of Algorithms–E.Horowitzetal.
4. AlgorithmDesign, 1st Edition, JonKleinbergandEvaTardos,Pearson.
5. AlgorithmDesign:Foundations,Analysis,andInternetExamples,SecondEdition,MichaelTGoodricha ndRobertoTamassia,Wiley.
6. Algorithms –ACreativeApproach,3rd Edition,UdiManber,Addison-Wesley,Reading,MA.
7. Design&AnalysisofAlgorithms,GajendraSharma,KhannaPublishing House (AICTERecommendedTextbook–2018)
8. AlgorithmsDesignandAnalysis,UditAgarwal,DhanpatRai.

Design & Analysis of Algorithms Laboratory

Code: PCC-CS494

Contact Hours:2L

Credit: 2

Pre-Requisite: -PCC-CS301,Data Structure and Algorithm

Course Outcome:

1. To apply knowledge of computing and mathematics to algorithm design
2. To analyze a problem and identify the computing requirements appropriate for its solution
3. To design, implement, and evaluate an algorithm to meet desired needs
4. To apply mathematical foundations, algorithmic principles, and computer science theory to the modeling and design of computer-based systems in a way that demonstrates comprehension of the trade-offs involved in design choices.

Topic: -

Module1:DivideandConquerAlgorithm:
Implement Binary Search using Divide and Conquer approach, Implement Merge Sort using Divide and Conquerapproach, Implement Quick Sort using Divide and Conquer approach, Find the Maximum and the Minimumelement from a given array of integers using Divide and Conquer approach, Find the Median of two sorted arraysusing Divide and Conquer approach, Find the Bitonicpoint in Bitonic sequence using Divide and Conquerapproach, Implement the Multiplication of two matrices using Strassen's Divide and Conquer approach, Find theneighborsoftheMedianelementusingthepartitioningstrategyofQuickSortingmethod.

Module2:Linear-timeSortingAlgorithm:
ImplementCountSort,ImplementDictionarySortingStrategy.

Module 3: Dynamic Programming:
Implement the Coin-exchange problem using Dynamic Programming, Find the Minimum number of scalar multiplications needed for a given chain of matrices using Dynamic Programming, Implement the Single Source Shortest Paths problem for a given directed graph (Bellman-Ford algorithm), Implement the All-Pair Shortest Paths problem for a given directed graph (Floyd-Warshall algorithm), Implement the Traveling Salesman Problem using Held-Karp algorithm, Find the minimum edit distances to convert one string into another string using Dynamic Programming, Implement the 0-1 Knapsack problem using Dynamic Programming, Implement the Subset-Sum problem using Dynamic Programming.

Module 4: Branch and Bound:
Implement the 15-Puzzle Problem using Branch and Bound algorithm.

Module 5: Backtracking:
Implement the 8-Queen Problem using Backtracking, Implement the Graph Coloring Problem using Backtracking, Implement the Hamiltonian Problem using Backtracking.

Module 6: Greedy Algorithm:

Implement the Fractional Knapsack Problem using greedy method, Implement the Job sequencing with deadlines using greedy method, Implement the Single Source Shortest Paths problem for a given directed graph (Dijkstra's algorithm), Implement the Minimum Cost Spanning Tree using Prim's algorithm, Implement the Minimum Cost Spanning Tree using Kruskal's algorithm.

Module 7: Fundamental Graph Algorithm:
Implement Breadth First Search (BFS), Implement Depth First Search (DFS), Find all Strongly Connected components of a given directed graph using Kisarazu's algorithm, Implement the Union-Find algorithm, Find the Max-Flow of a given Flow network using Ford-Fulkerson method.

Module 8: String Matching Problem:
Implement the String-Matching Problem using Knuth-Morris-Pratt algorithm.

TextBooks:

1. Introduction to Algorithms,4th Edition,ThomasHCormen,CharlesELieserson, Ronald LRivestandCliffordStein,MITPress/McGraw-Hill.
2. AlgorithmsInANutshell,George T. Heineman,GaryPolliceandStanleySelkow,O'Reilly.
3. Fundamental of Algorithms–E.Horowitzetal.
4. AlgorithmDesign, 1st Edition, JonKleinbergandEvaTardos,Pearson.
5. AlgorithmDesign:Foundations,Analysis,andInternetExamples,SecondEdition,MichaelTGoodrichandRobertoTamassia,Wiley.
6. Algorithms –ACreativeApproach,3rd Edition,UdiManber,Addison-Wesley,Reading,MA.
7. Design&AnalysisofAlgorithms, GajendraSharma,KhannaPublishingHouse (AICTERecommendedTextbook–2018).

Artificial Intelligence & Machine Learning

Code: PCC-CS405
Contact Hours:2L
Credit: 2

Pre-Requisite: -Mathematics-III(DifferentialCalculus,Probability,Statistics),BSC301
Co-requisite: Design&AnalysisofAlgorithms,PCC-CS404

Course Outcome:

1.To develop an understanding of artificial intelligence and knowledge representation.
2.To develop concepts regarding search techniques.
3.To develop concepts related to machine learning and its types.
4.To develop skill to solve problems associated with supervised and unsupervised learning.

Topic: -

Module1: Introduction to Artificial Intelligence, The Foundations of Artificial Intelligence, The History of Artificial Intelligence, and the State of the Art.
Knowledge Representation A Knowledge Based Agent, Knowledge Representation, Reasoning & Logic, Propositional Logic, Inference in First-Order Logic
Search techniques: AI-Problem formulation, solving problems by searching, uninformed search strategies: depth first search, breadth first search, depth limited search, iterative deepening search, bi-directional search.
Module2: Heuristic search strategies [4L]: Basics of heuristics, hill climbing strategy, simulated annealing strategy, best-first search, A*search, constraint satisfaction problem solving strategy.
Adversarial search[2L]:AI-based interactive game playing scheme using the minimax strategy, alpha-beta pruning. Concept of XAI and types.
Module3: Introduction to Machine Learning[2L]: Machine learning and it'stypes; Applications of machine learning; Issues in machine learning.
Module4: Recapitulation of Linear Algebra, Bayes Theorem, Expectation, Variance, Matrix Calculus– Numerical Optimization–Gradient Descent
Module5: Linear Regression–Least Square Gradient Descent Method–Derivations–Goodness of Fit–Bias-Variance Trade off.
Module6: Logistic Regression–Sigmoid–Gradient of Logistic Regression–Binary classification, Cross Entropy cost function.
Module7: Artificial Neural Networks–Multinomial Classification–Backpropagation–Derivations, Realization of Gates (AND, OR, XOR, NAND)
Module 8: Introduction to Convolutional Neural Networks – Regularization - CNN architectures – LeNet – VGG

Net–Google Net–ResNet.Imageclassification–Hyperparameteroptimization–Transferlearning–casestudies
Module 9: Introduction to Recurrent Neural Networks – Deep RNNs – Bi-RNNs – Long Short-Term Memory – Vanishing gradient
Module 10: Recap - Data preprocessing – Normalization – Feature Selection – Feature Reduction – PCA – local linear embedding, ISO map, multidimensional scaling, Performance Evaluation of Classifiers – Cross Validation – Receiver Operating Characteristics Curve
Module 11: Lazy Learners – nearest neighbors – Decision Tree – CART – Ensemble Methods – Bagging –Boosting– Random Forest– Semi Supervised Learning
Module12: Clustering–Partitioning Methods– K-means– K-medoids– Fuzzy Clustering– Hierarchical methods– Agglomerative Nesting (AGNES)– Performance Evaluation

Text Books:

1. The Hundred-page Machine Learning Book by AndriyBurkov, 2019, ISBN 978-1999579500
2. Deep Learning by Ian Goodfellow, YoshuaBengio, Aaron Courville, 2016, ISBN 978-0262035613
3. Hands on Machine Learning with Scikit Learn and Tensorflow by AurélienGéron, 2017, ISBN 978-14919622

ArtificialIntelligence&MachineLearningLaboratory

Code:PCC-CS495
Contact Hours:2L
Credit: 1

Pre-Requisite:-Mathematics-III(DifferentialCalculus,Probability,Statistics),BSC301
Co-requisite: Design&AnalysisofAlgorithms,PCC-CS404

Course Outcome:

1.To develop an understanding of artificial intelligence and knowledge representation.
2.To develop concepts regarding search techniques.
3.To develop concepts related to machine learning and it's types.
4.To develop skill to solve problems associated with supervised and unsupervised learning

Topic:-

Module 1:

- Introduction to LOGIC programming problems (usingPROLOG)

Module 2:

- Familiarization with Numpy module inpython
- Familiarization with Pandas module inpython
- Data visualization and plotting using Matplotlib module inpython

Module 3:

- Implementation of Linear Regression usingpython
- Implementation of Ridge Regression inpython
- Implementation of Lasso Regression inpython
- Implementation of Decision Tree Regression inpython
- Implementation of Random Forest Regression inpython

Module 4:

- Implementation of Logistic Regression inpython
- Implementation of Decision Tree based classification inpython
- Implementation of Random Forest based classification inpython
- Implementation of Bagging method using python
- Implementation of Boosting method in python

Module 5:

- Implementation of unsupervised dimensionality reduction using Principal Component Analysis inpython
- Implementation of k-Means clustering usingpython
- Implement Locally linear embedding (LLE) using python
- Implement Isometric Mapping algorithm usingpython
- Implementation of Multi-dimensional Scaling (MDS) usingpython
- Implementation of t-distributed Stochastic Neighbor Embedding (t-SNE) algorithm inpython

Module 6:

- Implementation of Multi-Layer Perceptron in python
- Implementation of an Image classifier using 2-D Convolutional Neural Network (CNN) usingpython
- Implementation of Long Short Term Memory (LSTM) network usingpython

Module 7:

- Familiarization with Confusion Matrix-based model evaluation metrics usingpython
- Familiarization with Regression model evaluation metrics usingpython
- Familiarization with Clustering model evaluation metrics usingpython

Module 8:

- Implementation of Label Propagation using python
- Implementation of Label Spreading usingpython

TextBooks:

1.The Hundred-page Machine Learning Book by AndriyBurkov, 2019, ISBN 978-1999579500
2. Deep Learning by Ian Goodfellow, YoshuaBengio, Aaron Courville, 2016, ISBN 978-0262035613
3. Hands on Machine Learning with Scikit Learn and Tensorflow by AurélienGéron, 2017, ISBN 978-1491962299

Management-I (Finance&Accounting)

Code:HSMC401

Contact Hours:1L

Credit: 3

Pre-Requisite: -MOOC201,HSMC181,HighSchoolMaths

Course Outcome:

1. The students will be able to understand the concepts related to business

2. The students will be able to apply the financial statement analysis associated with financial Data in the organization

3. The students will be able to analyse the complexities associated with the management of cost of product and services in the organization

4. The students will be able to understand the concepts of accounting of managerial decisions and financial statements.

5. The students will be able to analyse the complexities associated with the management of cost of funds /capital in the organization

6. The students will be able to apply the concepts of capital budgeting decisions and corporate capital structures.

Topic: -

Module I: Meaning and Scope of Accounting (3L)

Need, development and definition of accounting, Accounting Principles: GAAP; Accounting Transactions: Accounting Equation, Concepts & Conventions of Accounting.

Module II: Journal & Ledger (6L)

Journal; Rules of debit and credit; Characteristics &Advantages,
Ledger-Ledger Preparation & Balancing of Account.

Module III: Trial Balance (4L)

Trial Balance; Capital and Revenue. Concept of Suspense Account

Module IV: Cost Accounting-Introduction (6L)

Nature and scope of cost accounting; Cost concepts and classification: direct, indirect, Preparation of Cost Sheet

Module V:

Meaning and Scope of Financial Management: (6L)

Profit vs wealth maximization; financial functions–investment, financing, and dividend decisions. Role of a CFO.

Module VI:

Capital Budgeting I: (5L) Basic Concept, Payback Period, Accounting rate of Return

TextBooks:

1. Hanif&Mukherjee:FinancialAccounting-1, McGraw hill.
2. Basu&Das:Cost&ManagementAccounting-1,Rabindra Library.
3. Dey, Dutta&Mukherjee:Cost&ManagementAccounting-1,BhattacharjeeBrothers.
4. Kar&Bagchi: FinancialManagement, DeyBookConcern.

UniversalHumanValues–IV

Code:HSMC402

Contact Hours:2L

Credit: 3

Pre-Requisite:- Fundamental knowledge of humanities & social science subjects till class 10th standard and knowledge of Economics up to class 11th standard.

Course Outcome:

1.The Course will give a holistic approach towards learning engineering.

2.It will encourage multi-disciplinary thoughts among budding engineers and make them more responsible citizens.

3.Students will get sensitized their students towards larger socio-economic, human, environmental and geographical concerns.

Topic: -

Module 1

Laws of Society:

Central Legislative System of India, State Legislative System of India, Indian Judiciary

Module 2 Heritage of India:

Islam and Early Muslim Invaders, Delhi Sultanate, Bhakti and Sufi Movement.

Module 3

Know Our Country:

Rivers of India, Vegetation of India, Climate of India, Transport of India

Module 4

Revenue and Expenditure of India:

Tax System of India, Balance of Payment, Industrial Reforms

Module 5

India and World:

Monthly Current Affairs Magazine

Module 6:

Universal Human Values:

Realising existence and co-existence at all levels, Holistic perception of Harmony in existence.

TextBooks: None

EnvironmentalSciences

Code:MC401

Contact Hours:1

Credit: 0

Pre-Requisite:- High School Environmental Education Knowledge

Course Outcome: -

1. Understand core concepts and methods from ecological and physical sciences and their application in environmental problem-solving.

2. Appreciate key concepts from economic, political, and social analysis as they pertain to the design and evaluation of environmental policies and institutions.
3. Appreciate the ethical, cross-cultural, and historical context of environmental issues and the links between human and natural systems.
4. Appreciate that one can apply systems concepts and methodologies to analyze and understand interactions between social and environmental processes.

Topic: -

Module 1: Basic ideas of environment, basic concepts, man, society & environment, their interrelationship Mathematics of population growth and associated problems, Importance of population study in environmental engineering, definition of resource, types of resource, renewable, non-renewable, potentially renewable, effect of excessive use vis-à-vis population growth, Sustainable Development. Materials balance: Steady state conservation system, steady state system with non-conservative pollutants, step function. Environmental degradation: Natural environmental Hazards like Flood, earthquake, Landslide-causes, effects and control/management; Anthropogenic degradation like Acid rain-cause, effects and control. Nature and scope of Environmental Science and Engineering.

Module 2: Elements of ecology: System, open system, closed system, definition of ecology, species, population, community, definition of ecosystem- components types and function. Structure and function of the following ecosystem: Forest ecosystem, Grassland ecosystem, Desert ecosystem, Aquatic ecosystems, Mangrove ecosystem (special reference to Sundar ban); Food chain [definition and one example of each food chain], Food web. (2L) Biogeochemical Cycle- definition, significance, flow chart of different cycles with only elementary reaction [Oxygen, carbon, Nitrogen, Phosphate, Sulphur]. Biodiversity- types, importance, Endemic species, Biodiversity Hot-spot, Threats to biodiversity, Conservation of biodiversity.

Module 3: Atmospheric Composition: Troposphere, Stratosphere, Mesosphere, Thermosphere, Tropopause and Mesopause. Energy balance: Conductive and Convective heat transfer, radiation heat transfer, simple global temperature model [Earth as a black body, earth as albedo], Problems. Greenhouse effects: Definition, impact of greenhouse gases on the global climate and consequently on sea water level, agriculture and marine food. Global warming and its consequence, Control of Global warming. Earth's heat budget. Lapse rate: Ambient lapse rate Adiabatic lapse rate, atmospheric stability, temperature inversion (radiation inversion). Atmospheric dispersion: Maximum mixing depth, ventilation coefficient, effective stack height, smokestack plumes and Gaussian plume model. Definition of pollutants and contaminants, Primary and secondary pollutants: emission standard, criteria pollutant. Sources and effect of different air pollutants- Suspended particulate matter, oxides of carbon, oxides of nitrogen, oxides ofsulphur, particulate, PAN. Smog, Photochemical smog and London smog. Depletion Ozone layer: CFC, destruction of ozone layer by CFC, impact of other green-house gases, effect of ozone modification. Standards and control measures: Industrial, commercial and residential air quality standard, control measure (ESP. cyclone separator, bag house, catalytic converter, scrubber (ventury), Statement with brief reference).

Module 4: Hydrosphere, Hydrological cycle and Natural water. Pollutants of water, their origin and effects: Oxygen demanding wastes, pathogens, nutrients, Salts, thermal application, heavy metals, pesticides, volatile organic compounds. (2L) River/Lake/ground water pollution: River: DO, 5-day BOD test, Seeded BOD test, BOD reaction rate constants, Effect of oxygen demanding wastes on river [deoxygenation, reaeration], COD, Oil, Greases, pH. Lake: Eutrophication [Definition, source and effect]. Ground water: Aquifers, hydraulic gradient, ground water flow (Definition only) Standard and control: Waste water standard [BOD, COD, Oil, Grease], Water Treatment system [coagulation and flocculation, sedimentation and filtration, disinfection, hardness and alkalinity, softening] Waste water treatment system, primary and secondary treatments [Trickling filters, rotating biological contractor, Activated sludge, sludge treatment, oxidation ponds] tertiary treatment definition. Water pollution due to the toxic elements and their biochemical effects: Lead, Mercury, Cadmium, and Arsenic

Module 5: Hydrosphere, Hydrological cycle and Natural water. Pollutants of water, their origin and effects: Oxygen demanding wastes, pathogens, nutrients, Salts, thermal application, heavy metals, pesticides, volatile organic compounds. River/Lake/ground water pollution: River: DO, 5-day BOD test, Seeded BOD test, BOD reaction rate constants, Effect of oxygen demanding wastes on river [deoxygenation, reaeration], COD, Oil, Greases, pH. Lake: Eutrophication [Definition, source and effect]. Ground water: Aquifers, hydraulic gradient,

ground water flow (Definition only) Standard and control: Waste water standard [BOD, COD, Oil, Grease], Water Treatment system [coagulation and flocculation, sedimentation and filtration, disinfection, hardness and alkalinity, softening] Waste water treatment system, primary and secondary treatments [Trickling filters, rotating biological contractor, Activated sludge, sludge treatment, oxidation ponds] tertiary treatment definition. Water pollution due to the toxic elements and their biochemical effects: Lead, Mercury, Cadmium, and Arsenic

TextBooks:

1. M.P.Poonia&S.C.Sharma,EnvironmentalStudies,KhannaPublishingHouse(AICTERecommendedTextbook–2018)
2. Masters,G.M.,"IntroductiontoEnvironmentalEngineeringandScience",Prentice-HallofIndiaPvt.Ltd., 1991.
3. De,A. K.,"EnvironmentalChemistry",NewAgeInternational

Mandatory Additional Requirements (MAR)
Code: MC481
Credit: 0

Innovative Project – II
Code: PROJ-CS401
Credit: 1

Massive Open Online Courses (Mandatory for B.Tech (Honours))
Code: MOOC 4
Credit: 1

B.Tech 3rd Year 5th Semester

Signals & Systems
Code: ESC501
Contact Hours: 3L
Credit: 3

Pre-requisites: - Inclination to learn mathematics, basic knowledge of differential equations and difference equations, electrical circuits and networks.

Course outcome:-
1. The course will provide strong foundation on signals and systems which will be useful for creating foundation of communication and signal processing.
2. The students will learn basic continuous time and discrete time signals and systems.
3. Student will understand application of various transforms for analysis of signals and systems both continuous time and discrete time.
4. Students will also explores to power and energy signals and spectrum.

Topic: -
Module-1:
1. Signals and systems as seen in everyday life, and in various branches of engineering and science.
2. Energy and power signals, continuous and discrete time signals, continuous and discrete amplitude signals.
3. System properties: linearity: additivity and homogeneity, shift- invariance, causality, stability, realizability.

Module -2:
1. Linear shift-invariant (LSI) systems, impulse response and step response, convolution, input- output behavior with a periodic convergent inputs.
2. Characterization of causality and stability of linear shift invariant systems. System representation through differential equations.

Module -3:
1. Periodic and semi-periodic inputs to an LSI system, the notion of a frequency response and its relation to the impulse response, Fourier series representation, the Fourier Transform, convolution/multiplication and their effect in the frequency domain, magnitude and phase response, Fourier domain duality.
2. The Discrete-Time Fourier Transform (DTFT) and the Discrete Fourier Transform (DFT).
3. Parseval's Theorem. The idea of signal space and orthogonal bases.

Module-4:
1. Evolution of Transforms: Fourier Transform, Laplace Transform , Z-transform (single sided and Double sided).
2. The Laplace Transform, notion of eigen functions of LSI systems, a basis of eigen functions, region of convergence, poles and zeros of system, , solution to differential equations and system behavior using Laplace Transformation.
3. The z-Transform for discrete time signals and systems- eigen functions, region of convergence, z-domain analysis.

Module-5:
1. The Sampling Theorem and its implications- Spectra of sampled signals. Reconstruction: ideal interpolator, zero-order hold, first-order hold, and so on. Aliasing and its effects.
2. Relation between continuous and discrete time systems.

Text/Reference books:

1. A.V. Oppenheim, A.S. Willsky and I.T. Young, "Signals and Systems", Prentice Hall, 1983.
2. R.F. Ziemer, W.H. Tranter and D.R. Fannin, "Signals and Systems - Continuous and Discrete", 4th edition, Prentice Hall, 1998.
3. Papoulis, "Circuits and Systems: A Modern Approach", HRW, 1980

Database Management Systems
Code:PCC-CS501
Contact Hours:3L
Credit: 3

Pre-Requisite:- Fundamentals of Mathematics, algebra, calculus etc.

Course Outcome: –

1. To understand the different issues involved in the design and implementation of a database system.
2. To study the physical and logical database designs, database modelling, relational, hierarchical, and network models
3. To understand and use data manipulation language to query, update, and manage a database
4. To develop an understanding of essential DBMS concepts such as: database security, integrity, concurrency,
5. To design and build a simple database system and demonstrate competence with the fundamental tasks involved with modelling, designing, and implementing a DBMS.
6. File & Record Concept, Placing file records on Disk, Fixed and Variable sized Records, Types of Single-Level Index (primary, secondary, clustering), Multilevel Indexes, Dynamic Multilevel Indexes using B tree and B+ tree .

Topic: -
Module-1:
1**.** Introduction
Concept & Overview of DBMS, Data Models, Database Languages, Database Administrator, Database Users, Three Schema architecture of DBMS.

Module-2:
1. Entity-Relationship Model
Basic concepts, Design Issues, Mapping Constraints, Keys, Entity-Relationship Diagram, Weak Entity Sets, Extended E-R features.

Module-3:
1. Relational Model
Structure of relational Databases, Relational Algebra, Relational Calculus, Extended Relational Algebra Operations, Views, Modifications Of the Database.

Module-4:
1.SQL and Integrity Constraints

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

2. Relational Database Design
Functional Dependency, Different anamolies in designing a Database., Normalization using funtional dependencies, Decomposition, Boyce-Codd Normal Form, 3NF, Nomalization using multi-valued depedencies, 4NF, 5NF

Module-5:
1. Internals of RDBMS
Physical data structures, Query optimization : join algorithm, statistics and cost bas optimization. Transaction processing, Concurrency control and Recovery Management : transaction model properties, state serializability, lock base protocols, two phase locking.

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

Text Books/ Reference Books:
1. Henry F. Korth and Silberschatz Abraham, "Database System Concepts", Mc.Graw Hill.
2. Elmasri Ramez and Novathe Shamkant, "Fundamentals of Database Systems", Benjamin Cummings Publishing. Company.
3. Ramakrishnan: Database Management System , McGraw-Hill
4. Gray Jim and Reuter Address, "Transaction Processing : Concepts and Techniques", Moragan Kauffman Publishers.
5. Jain: Advanced Database Management System CyberTech
6. Date C. J., "Introduction to Database Management", Vol. I, II, III, Addison Wesley.
7. Ullman JD., "Principles of Database Systems", Galgottia Publication.
8. James Martin, "Principles of Database Management Systems", 1985, Prentice Hall of India, New Delhi
9. "Fundamentals of Database Systems", Ramez Elmasri, Shamkant B.Navathe, Addison Wesley Publishing Edition
10. "Database Management Systems", Arun K.Majumdar, Pritimay Bhattacharya, Tata McGraw Hill

Database Management Systems Laboratory
Code: PCC-CS591
Contact Hours:2L
Credit: 2

Pre-Requisite:- Fundamentals of Mathematics, algebra, calculus etc., Database Management System PCC-CS501

Course Outcome: –

1. To explain basic database concepts, applications, data models, schemas and instances.
2. To demonstrate the use of constraints and relational algebra operations.
3. Describe the basics of SQL and construct queries using SQL.

4. To emphasize the importance of normalization in databases.
5. To facilitate students in Database design
6. To familiarize issues of concurrency control and transaction management.

Topic: -
Module-1:
1. Structured Query Language
Creating Database, Creating a Database, Creating a Table, Specifying Relational Data Types, Specifying Constraints, Creating Indexes

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

Module-3:
1. Retrieving Data from a Database
The SELECT statement, Using the WHERE clause, Using Logical Operators in the WHERE clause, Using IN, BETWEEN, LIKE , ORDER BY, GROUP BY and HAVING Clause, Using Aggregate Functions, Combining Tables Using JOINS, Sub-queries

Module-4:
1. Database Management
Creating Views, Creating Column Aliases, Creating Database Users, Using GRANT and REVOKE, Basics of PL/SQL & its implementations
Text Books/ Reference Books:
1. Henry F. Korth and Silberschatz Abraham, "Database System Concepts", Mc.Graw Hill.
2. Elmasri Ramez and Novathe Shamkant, "Fundamentals of Database Systems", Benjamin Cummings Publishing. Company.
3. Ramakrishnan: Database Management System , McGraw-Hill
4. Gray Jim and Reuter Address, "Transaction Processing : Concepts and Techniques", Moragan Kauffman Publishers.
5. Jain: Advanced Database Management System CyberTech
6. Date C. J., "Introduction to Database Management", Vol. I, II, III, Addison Wesley.
7. Ullman JD., "Principles of Database Systems", Galgottia Publication.
8. James Martin, "Principles of Database Management Systems", 1985, Prentice Hall of India, New Delhi
9. "Fundamentals of Database Systems", Ramez Elmasri, Shamkant B.Navathe, Addison Wesley Publishing Edition
10. "Database Management Systems", Arun K.Majumdar, Pritimay Bhattacharya, Tata McGraw Hill

Formal Language & Automata Theory
Code: PCC-CS502
Contact Hours:3L
Credit: 3

Pre-Requisite:- Elementary discrete mathematics includes the notion of set, function, relation, product, partial order, equivalence relation, graph& tree. They should have a thorough understanding of the principle of mathematical induction.

Course Outcome: –

1. After studying Finite Automata, student will be able to define a system and recognize the behavior of a system. They will be able to minimize a system and compare different systems.
2. After studying regular language and grammer student will convert Finite Automata to regular expression. Students will be able to check equivalence between regular linear grammar and FA.
3. After studying CFG and PDA Students will be able to minimize context free grammar. Student will be able to check equivalence of CFL and PDA. They will be able to design.
4. After studying turing machine Students will be able to design Turing machine.

Topic: -

Module-1:

1. Introduction to concepts of alphabet, language, production rules, grammar and automaton, finite state model, concept of DFA and its problems, concept of NFA and its problems.
2. NFA to DFA conversion, Construction of DFA & NFA for any given string and vice versa, Minimization of FA and equivalence of two FA, Mealy & moore machine and their problems. Limitations of FSM.

Module-2:

1. Introduction to the concept of Chomosky Classification of Grammar, language generation from production rules and vice- versa. regular language and regular expressions, identity rules.
2. Arden's theorem state and prove, Construction of NFA from regular expression, Conversion of NFA with null moves to without null moves, closure properties, pumping lemma and its applications.

Module-3:

1. Introduction to Context Free Grammer, Derivation trees, sentential forms. Right most and leftmost derivation of strings, concepts of ambiguity. Minimization of CFG, Chomsky normal form, Greibach normal form, Pumping Lemma for Context Free Languages, Enumeration of properties of CFL (proofs omitted).
2. Closure property of CFL, Ogden's lemma & its applications, Push Down Automata: Push down automata, definition and description, Acceptance of CFL, Acceptance by final state and acceptance by empty state and its equivalence, Equivalence of CFL and PDA, interconversion, DCFL and DPDA.

Module-4:

1. Turing Machine : Turing Machine, definition, model, Design of TM, Computable functions, Church's hypothesis, counter machine, Types of Turing machines (proofs not required), Universal Turing Machine, Halting problem, P, NP.

Module-5:

1. Basic definition of sequential circuit, block diagram, mathematical representation, concept of transition table and transition diagram, Design of sequence detector.
2. Finite state machine:Definitions, capability & state equivalent, kth- equivalent concept, Merger graph, Merger table.
3. Compatibility graph, Finite memory definiteness, testing table & testing graph.

Text Books:

1. John E. Hopcroft, Rajeev Motwani and Jeffrey D. Ullman, Introduction to Automata Theory, Languages, and Computation, Pearson Education Asia.
2. Harry R. Lewis and Christos H. Papadimitriou, Elements of the Theory of Computation, Pearson Education Asia.
3. Dexter C. Kozen, Automata and Computability, Undergraduate Texts in Computer Science, Springer.
4. Michael Sipser, Introduction to the Theory of Computation, PWS Publishing.
5. John Martin, Introduction to Languages and The Theory of Computation, TataMcGraw Hill., PEARSON.
6. Dr. R.B.Patel, Theory of Computation, Khanna Publishing House

Object Oriented Programming
Code: PCC-CS503
Contact Hours: 3L
Credit: 3

Pre-requisites: Problem Solving Techniques and Basics of Computer Programming (like C, C++).

Course Outcome: –

1. To familiarize with the object-oriented programming concepts.
2. To understand object-oriented programming concepts, and apply them in solving problems.
3. To introduce the principles of inheritance and polymorphism; and demonstrate howtheyrelate to the design of abstract classes.
4. To introduce the implementation of packages andinterfaces.
5. To introduce the concepts of exception handling and multithreading.
6. To introduce the design of Graphical User Interface using applets and swing controls.

Topic: -
Module-1:
1.Introduction to Object-Oriented Thinking
• Difference between OOP and other conventional programming – advantages and disadvantages
• Class, object, message passing,
• Encapsulation,
• Inheritance,
• Polymorphism
• Software Design
• Software Development Life Cycle

Module-2:
1. Object-Oriented Programming Constructs
• Class, Object,
• Relationships among classes- association, dependency (use, call), aggregation, grouping, generalisation
• Relationships among objects - instantiation, links
• Meta-class
• Modelling with UML Class and Sequence Diagrams 9

Module-3:
1. Designing for Reuse
• Good design principles e.g. Single Responsibility Principle (SRP). Don’t Repeat Yourself (DRY) Principle.

• Interfaces and abstract classes.
• Loose coupling.
• Inheritance versus Delegation.

Module-4:
1. Basic concepts of Java programming. Advantages of Java, byte-code & JVM, data types, access specifiers, operators, control statements & loops, for-each loop, array, creation of class, object, constructor, object class, finalize and garbage collection, use of method overloading, this keyword, use of objects as parameter & methods returning objects, call by value & call by reference, variable length arguments, static block, variables & methods, nested & inner classes.

Module-5:
1. String Classes. String class, concept of string pool, concept of mutable and immutable string, basic methods of String class, StringBuffer class, basic methods of StringBuffer class, Introduction to StringBuilder class, basic methods of StringBuilder class, comparisons.

Module-6:
1. Basic of I/O operations. Command line argument, basic of I/O, different types of streams, basic stream classes, introduction to BufferedReader class, basic file handling, introduction to Scanner class.
2. Reusability properties. Super class & subclasses including multilevel hierarchy, process of constructor calling in inheritance, use of super and final keywords comparison between super and this, dynamic method dispatch, method hiding, object type casting, use of abstract classes & methods, interfaces.
3. Package. Introduction to package concept, Advantage of using package concept, basic inbuilt packages, package creation, different ways of importing packages, member access for packages.

Module-7:
1. Exception handling. Exception handling basics, different types of exception classes, use of try & catch with throw, throws & finally, try with resources, creation of user defined exception classes.
2. Threading. Introduction to process, scheduling, context switching, difference between process and thread, basics of multithreading, main thread, thread life cycle, creation of multiple threads, thread priorities, thread synchronization, inter-thread communication, deadlocks for threads, suspending & resuming threads.
3. Swing. Advanced Topics: Basic concepts of AWT library, Creation of GUI using Swing library, Event Driven Programming (implementing ActionListener to multiple buttons, MouseListener, KeyListener interfaces), Painting (drawing objects) using AWT.
4. Generic class and Collection framework. Introduction to generic class, advantage of generic class user defined generic class & method, introduction to collection framework, advantages, different classes, iterator.

Text Books:
1. Rambaugh, James Michael, Blaha – "Object Oriented Modelling and Design" – Prentice Hall, India
2. Ali Bahrami – "Object Oriented System Development" – Mc Graw Hill
3. Patrick Naughton, Herbert Schildt – "The complete reference-Java2" – TMH
4. R.K Das – "Core Java For Beginners" – VIKAS PUBLISHING
5. Deitel and Deitel – "Java How to Program" – 6th Ed. – Pearson
6. Ivor Horton's Beginning Java 2 SDK – Wrox
7. E. Balagurusamy – " Programming With Java: A Primer" – 3rd Ed. – TMH

Object Oriented Programming Laboratory
Code: PCC-CS593
Contact Hours: 2L
Credit: 2

Pre-requisites: Problem Solving Techniques and Basics of Computer Programming (like C, C++), PCC-CS593

Course Outcome: –

1. To understand object-oriented programming concepts, and apply them in solving problems.
2. To understand the additional features of Java compared to C++.
3. Identify the difference between Compiler and Interpreter.
4. Identify the difference between applet and application.
5. Apply Object Oriented Principles of Encapsulations, Data abstraction, Inheritance,
6. Polymorphism. Program using Exception Handling, Files and Threads.
7. Program Using applets and swings.

Topic: -
1. Assignments on class, constructor, overloading, inheritance, overriding
2. Assignments on wrapper class, arrays
3. Assignments on developing interfaces- multiple inheritance, extending interfaces
4. Assignments on creating and accessing packages
5. Assignments on multithreaded programming
6. Assignments on applet programming

Note: Use Java for programming
Preferably download "**java_ee_sdk-6u4-jdk7-windows.exe**" from
http://www.oracle.com/technetwork/java/javaee/downloads/java-ee-sdk-6u3-jdk-7u1-downloads-523391.html

Text Books:
1. Rambaugh, James Michael, Blaha – "Object Oriented Modelling and Design" – Prentice Hall, India
2. Ali Bahrami – "Object Oriented System Development" – Mc Graw Hill
3. Patrick Naughton, Herbert Schildt – "The complete reference-Java2" – TMH
4. R.K Das – "Core Java For Beginners" – VIKAS PUBLISHING
5. Deitel and Deitel – "Java How to Program" – 6th Ed. – Pearson
6. Ivor Horton's Beginning Java 2 SDK – Wrox

Software Engineering
Code: PCC-CS504
Contact Hours: 3L
Credit: 2

Pre-requisite:-
1. Knowledge of 12th standard mathematics.
2. Basic knowledge of programming in any language.
3. Basic knowledge of HTML, Java Script and CSS.
4. Knowledge of Database Management Systems.
5. Knowledge of flowchart, data-structure, algorithm, graph and tree.

Course Outcome: -

1. The subject's goal is to provide a professionally guided education in software engineering that prepares graduates to transition into a broad range of career options: industry, government, computing graduate program, and professional education.
2. Within a few years of completion, graduates exhibit the following characteristics.
3. Demonstrates agility in solving software and system challenges with a comprehensive set of skills appropriate to the needs of the dynamic global computing-based society.
4. Capable of diverse team and organizational leadership in computing project settings.
5. Demonstrates ethical principles in the application of computing-based solutions to societal and organizational problems.
6. Continually acquires skills and knowledge to support a professional pathway, including (but not limited to) communication, analytic, and technical skills.

Topic: -

Module-1:

1.Software Engineering –Objectives, Definitions, Software Process models – Waterfall Model, Prototype model, RAD, Evolutionary Models, Incremental, Spiral.

2. Software Project Planning- Feasibility Analysis, Technical Feasibility, Cost- Benefit Analysis, COCOMO model.

Module-2:

1. Structured Analysis, Context diagram and DFD, Physical and Logical DFDs, Data Modelling, ER diagrams, Software Requirements Specification

Module-3:

1. Design Aspects :Top-Down And Bottom-Up design; Decision tree, decision table and structured English, Structure chart, Transform analysis Functional vs. Object- Oriented approach.

Module-4:

1. Unified Modelling Language, Class diagram, interaction diagram: collaboration diagram, sequence diagram, state chart diagram, activity diagram, implementation diagram

Module-5:

1. Coding & Documentation – Structured Programming, Modular Programming, Module Relationship- Coupling, Cohesion, OO Programming, Information Hiding, Reuse, System Documentation.
2. Testing – Levels of Testing, Integration Testing, System Testing.
3. Software Quality, Quality Assurance, Software Maintenance, Software Configuration Management, Software Architecture.

Text Books:

1. Software Engineering: A practitioner's approach– Pressman (TMH)
2. Software Engineering- Pankaj Jalote (Wiley-India)
3. Software Engineering- Rajib Mall (PHI)
4. Software Engineering –Agarwal and Agarwal (PHI)

Software Engineering Laboratory
Code: PCC-CS594
Contact Hours: 2L
Credit: 1

Pre-requisite:
1. Knowledge of 12th standard mathematics.
2. Basic knowledge of programming in any language.
3. Basic knowledge of HTML, Java Script and CSS.
4. Knowledge of Database Management Systems.
5. Knowledge of flowchart, data-structure, algorithm, graph and tree.

Course Outcome: -

1. The subject's goal is to provide a professionally guided education in software engineering that prepares graduates to transition into a broad range of career options: industry, government, computing graduate program, and professional education.
2. Within a few years of completion, graduates exhibit the following characteristics.
3. Demonstrates agility in solving software and system challenges with a comprehensive set of skills appropriate to the needs of the dynamic global computing-based society.
4. Capable of diverse team and organizational leadership in computing project settings.
5. Demonstrates ethical principles in the application of computing-based solutions to societal and organizational problems.

Topic: -

Module 1: Software Engineering Basics

Develop requirements specification for a given problem, Develop DFD Model (Level 0, Level 1 DFD and data dictionary) of the sample problem (Use of a CASE tool required), Develop Structured design for the DFD model developed, Develop UML Use case model for a problem (Use of a CASE tool any of Rational rose, ArgoUML, or Visual Paradigm etc. is required), Develop Sequence Diagrams, Develop Class diagrams.

Module 2: Java Database Connectivity (JDBC)

Overview of RDBMS, Introduction to JDBC, JDBC Architecture, Types of JDBC Drivers, Establishing a JDBC Connection, Using Statement, Using Prepared Statement, Using Callable Statement.

Module 3: Java Servlets

What is a Web-Container,Servlet Life Cycle / Architecture, HTTP GET and POST Request Methods, Processing Html Forms, s Name-Value pair, Content Types and MIME, Configuration of Web Application, Understanding the Deployment Descriptor (DD) / web.xml, Servlet URL Pattern Mapping, g HTTP Session, Cookies.

Module 4: Java Server Pages (JSP)

JSP Architecture, JSP Standard / Implicit Objects, Request, Reponse, Out, config, Application, session, page, page Context, exception, JSP Basic syntax, Tags (Directive Tags, Action Tags, Script related Tags, Scriptlet Tag, Expression Tag, Declaration Tag, setProperty Tag....).

Text Books:

1. Software Engineering: A practitioner's approach– Pressman (TMH)
2. Software Engineering- Pankaj Jalote (Wiley-India)
3. Software Engineering- Rajib Mall (PHI)
4. Software Engineering –Agarwal and Agarwal (PHI)

Humanities – II (Principles of Management)
Code: HSMC501
Contact Hours: 3L
Credit: 3

Pre-Requisite:- No Pre-requisite or co-requisite is required for this subject.

Course Outcome: -

1. To understand the roles and functions of managers at various (entry, middle and the top) levels
2. To explain the relationships between organizational mission, goals, and objectives
3. To comprehend the significance and necessity of managing stakeholders
4. To conceptualize how internal and external environment shape organizations and their responses
5. To demonstrate empirical understanding of various organizational processes and behaviors and the theories associated with them.
6. To demonstrate critical thinking skills in identifying ethical, global, and diversity issues in planning, organizing, controlling and leading functions of management.
7. To understand organizational design and structural issues

Topic: -

Module-1:
1. Basic concepts of management: Definition – Essence, Functions, Roles, Level.
2. Functions of Management: Planning – Concept, Nature, Types, Analysis, Management by objectives;

Module-2:
1. Organization Structure – Concept, Structure, Principles, Centralization, Decentralization, Span of Management; Organizational Effectiveness.
2. Management and Society – Concept, External Environment, CSR, Corporate Governance, Ethical Standards.

Module-3:
1. People Management – Overview, Job design, Recruitment & Selection, Training & Development, Stress Management.
2. Managerial Competencies – Communication, Motivation, Team Effectiveness, Conflict Management, Creativity, Entrepreneurship.

Module-4:
1. Leadership: Concept, Nature, Styles.
2. Decision making: Concept, Nature, Process, Tools & techniques.
3. Economic, Financial & Quantitative Analysis – Production, Markets, National Income Accounting, Financial

Module-5:
1. Function & Goals, Financial Statement & Ratio Analysis, Quantitative Methods – Statistical Interference, Forecasting, Regression Analysis, Statistical Quality Control.
2. Customer Management – Market Planning & Research, Marketing Mix, Advertising & Brand Management.
3. Operations & Technology Management – Production & Operations Management, Logistics & Supply Chain Management, TQM, Kaizen & Six Sigma, MIS.

Text Books:
1. Management: Principles and Practice by S.K. Mandal, Jaico Publishing House
2. Management Principles and Practices by Parag Diwan

3. Principles and Practices of Management by Partho S. Sengupta, Vikas Publishing House
4. Principles and Practice of Management by L.M. Prasad, Sultan Chand & Sons
5. Principles & Practices of Management (B.Tech) by Rajul Dutt, Krishan Prakashan

Professional Elective – I
Code: PEC-CS501
Contact Hours: 3L
Credit: 3

Option – 1. Neural Networks and Deep Learning

Pre-Requisite:- Mathematics (Linear Algebra, Vector Calculus, Probability), Machine Learning

Course Outcome: -

1. Model Neuron and Neural Network, and to analyze ANN learning, and its applications.
2. Perform Pattern Recognition, Linear classification.
3. Develop different single layer/multiple layer Perception learning algorithms
4. Design of another class of layered networks using deep learning principles.

Topic: -
Module -1:
1. Fundamentals of Neural Network & Deep Learning:
Challenges in shallow network; Motivation for deep neural network, Different deep neural network architectures – Perceptron, Feedforward network, etc. Forward and backward propagation, Gradient Descent and related problems, Regularization, Batch normalization, Optimization algorithms (Adam's, RMSprop, etc.), Hyperparameters

Module -2:
1. Convolutional Neural Network:
Foundational concepts of CNN, Building a CNN architecture, Popular CNN architectures – LeNet, AlexNet, ResNet, CNN applications

Module -3:
1. Recurrent Neural Network:
Sequence data, Architecture of RNN, Long Short Term Memory (LSTM),Bi-directional LSTM, Gated Recurrent Unit (GRU),Applications of RNN

Module -4:
1. Important deep learning frameworks: Tensorflow 2.0, Keras, PyTorch, Theano, Caffe

Text Books:

1. Ian Goodfellow, Yoshua Bengio, Aaron Courville, Francis Bach, Deep Learning, The MIT Press.
2. Fundamentals of Deep Learning – by Nikhil Buduma (O'Reilly).
3. Deep Learning – A practitioner's approach – by Josh Patterson & Adam Gibson (O'Reilly).

Option – 2. Cyber Security

Pre-Requisite:- No Pre-requisite or co-requisite is required for this subject.

Course Outcome: -

1. Analyze and evaluate the cyber security needs of an organization.
2. Conduct a cyber security risk assessment.
3. Measure the performance and troubleshoot cyber security systems.
4. Implement cyber security solutions.
5. Be able to use cyber security, information assurance, and cyber/computer forensics software/tools.

Topic: -

Module-1:

1. Introduction to Cyber Space. History of Internet , Cyber Crime , Information Security , Computer Ethics and Security Policies, Choosing the Best Browser according to the requirement and email security: Guidelines to choose web browsers , Securing web browser, Antivirus, Email security

2. Guidelines for secure password and wi-fi security, Guidelines for setting up a Secure password, Two-steps authentication, Password Manager, Wi-Fi Security

Module-2:

1. Guidelines for social media and basic Windows security, Guidelines for social media security, Tips and best practices for safer Social Networking, Basic Security for Windows, User Account Password, Smartphone security guidelines

2. Introduction to mobile phones, Smartphone Security, Android Security, IOS Security, Cyber Security Initiatives in India, Counter Cyber Security Initiatives in India, Cyber Security Exercise, Cyber Security, Incident Handling , Cyber Security Assurance

Module-3:

1. Online Banking, Credit Card and UPI Security, Online Banking Security, Mobile Banking Security, Security of Debit and Credit Card, UPI Security

2. Micro ATM, e-wallet and POS Security, Security of Micro ATMs, e-wallet Security Guidelines, Security Guidelines for Point of Sales(POS).

Module-4:

1. Social Engineering, Types of Social Engineering, How Cyber Criminal Works, How to prevent for being a victim of Cyber Crime, Cyber Security Threat Landscape and Techniques, Cyber Security Threat Landscape Emerging Cyber Security Threats, Cyber Security Techniques, Firewall

2. IT Security Act and Misc. Topic, IT Act, Hackers-Attacker-Countermeasures, Web Application Security Digital Infrastructure Security, Defensive Programming, Information Destroying and Recovery Tools, Recovering from Information Loss, Destroying Sensitive Information, CCleaner for Windows

Text Books:

1. Introduction to Cyber Security available at http://uou.ac.in/foundation-course
2. Fundamentals of Information Security http://uou.ac.in/progdetail?pid=CEGCS-17
3. Cyber Security Techniques http://uou.ac.in/progdetail?pid=CEGCS-17
4. Cyber Attacks and Counter Measures: User Perspective http://uou.ac.in/progdetail?pid=CEGCS-17
5. Information System http://uou.ac.in/progdetail?pid=CEGCS-17

Constitution of India & Essence of Indian Knowledge Tradition
Code: MC501
Contact Hours: 3L
Credit: 0

Pre-Requisite:- Fundamental knowledge of humanities & social science subjects (civics) till class 10th standard.

Course Outcome: -

1. Understand the meaning and importance of Constitution and the Preamble of the Indian Constitution and its significance, describe the Salient (Outstanding) features of Indian Constitution.
2. Understand and analyse federalism in the Indian context.
3. Understand and analyse the three organs of the state in the contemporary scenario.
4. Analyse Panchayathi Raj institutions as a medium of decentralization

Topic:
Module 1
Indian Constitution: Sources and constitutional history, Features: Citizenship, Preamble, Fundamental Rights and Duties, Directive Principles of State Policy.

Module 2
Union government and its administration: Structure of the Indian Union: Federalism, Centre- State relationship, President: Role, power and position, PM and Council of ministers, Cabinet and Central Secretariat, Lok Sabha, Rajya Sabha. State government and its administration: Governor: Role and Position, CM and Council of ministers, State Secretariat: Organisation, Structure and Functions.

Module 3
Supreme court: Organization of supreme court, procedure of the court, independence of the court, jurisdiction and power of supreme court. High court: Organization of high court, procedure of the court, independence of the court, jurisdiction and power of supreme court. Subordinate courts: constitutional provision, structure and jurisdiction. National legal services authority, Lok adalats, family courts, gram nyayalays. Public interest litigation (PIL): meaning of PIL, features of PIL, scope of PIL, principle of PIL, guidelines for admitting PIL.

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

Text Books:
1. Indian polity, M, Laxmikanth, MC Graw Hill education, 5th Edition.
2. DD Basu, "Introduction to the constitution of India", 21st Edition, Lexis Nexis Books Publication ltd, India3.
3. Magbook: Indian Polity and Governance- Arihant Publication

Universal Human Values – V
Code: HSMC502
Contact Hours: 3L
Credit: 3

Pre-Requisite:- A student is required to possess a basic knowledge various subjects related to Engineering and Science along with the awareness of current national and international happenings. He/she should be aware of the types of questions being asked in GATE examination.

Course Outcome: -

1. This subject is taught to polish and enhance various aptitude skills and cognitive knowledge of the students and prepare them to be successful in the fields different competitive examinations like GATE,CAT, MAT,GMAT,UPSC, WBCS, Banking services, Indian Defence Services ,Combined Graduate Level etc.
2. This way our students are trained not only for private sectors but also for public sectors to secure a fulfilling career.

Topic:

1. Questions from GATE to be solved by students. (6000 + questions).
2. NET equivalent examinations related questions to be solved from engineering domain.
3. CAT previous years question solved.
4. Banking Services questions solved.

Text Books: NONE

Mandatory Additional Requirements (MAR)
Code: MC581
Credit: 0

Innovative Project – III
Code: PROJ-CS501
Contact Hours: 3L
Credit: 1

Massive Open Online Courses (Mandatory for B.Tech (Honours))
Code: MOOC 5
Credit: 2

B.Tech 3rd Year 6th Semester

Compiler Design
Code: PCC-CS601
Contact Hours: 3L
Credit: 3

Pre-Requisite:- 1. Formal Language & Automata Theory
2. Data Structures & Algorithms

Course Outcome: -

1. To understand object oriented programming concepts, and apply them in solving problems.
2. To understand the additional features of Java compared to C++.
3. Identify the difference between Compiler and Interpreter.
4. Identify the difference between applet and application.
5. Apply Object Oriented Principles of Encapsulations, Data abstraction, Inheritance, Polymorphism.

Program using Exception Handling, Files and Threads.
6. Program Using applets and swings.

Topic:-

Module I

Introduction to Compiling

Compilers, Analysis-synthesis model , The phases of the compiler, Cousins of the compiler.

Lexical Analysis

The role of the lexical analyzer, Tokens, Patterns, Lexemes, Input buffering, Specifications of a token, Recognition of tokens, Finite automata, From a regular expression to an NFA, From a regular expression to NFA, From a regularexpression to DFA, Design of a lexical analyzer generator (Lex).

Module II

Syntax Analysis

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

Syntax directed translation

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

Module III

Type checking

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

Run time environments

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

Module IV

Intermediate code generation

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

Code optimization

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

Code generations

Issues in the design of code generator, a simple code generator, Register allocation & assignment.

Text Books:

1. Aho, Sethi, Ullman - “Compiler Principles, Techniques and Tools” - Pearson Education.
2. Holub - “Compiler Design in C” – PHI
3.Tremblay and Sorenson Compiler Writing-McgrawHill International .
4. Chattopadhyay , S- Compiler Design (PHI)

Compiler Design Laboratory
Code: PCC-CS691
Contact Hours: 2L
Credit: 2

Pre-Requisite:- 1. Formal Language & Automata Theory
2. Data Structures & Algorithms

Course Outcome: -

1. To introduce the major concept areas of language translation and compiler design.
2. To develop the knowledge of application of basic data structures and automata theory in different phases of compiler design
3. To enrich the knowledge in various phases of compiler and its use.
4. To extend the knowledge of parser by parsing LL parser and LR parser.

Topic:-

1.Implementation of Symbol Table
2. Develop a lexical analyzer to recognize a few patterns in C. (Ex. identifiers, constants, comments, operators etc.)
3. Implementation of Lexical Analyzer using Lex Tool
4. Generate YACC specification for a few syntactic categories.
a) Program to recognize a valid arithmetic expression that uses operator +, – , * and /.
b) Program to recognize a valid variable which starts with a letter followed by any number of letters or digits.
c)Implementation of Calculator using LEX and YACC
5. Convert the BNF rules into Yacc form and write code to generate Abstract Syntax Tree.
6. Implement type checking
7. Implement control flow analysis and Data flow Analysis
8. Implement any one storage allocation strategies(Heap,Stack,Static)
9. Construction of DAG
10. Implement the back end of the compiler which takes the three address code and produces the 8086 assembly language instructions that can be assembled and run using a 8086 assembler.The target assembly instructions can be simple move, add, sub, jump. Also simple addressing modes are used.

Text Books:

1. Aho, Sethi, Ullman - “Compiler Principles, Techniques and Tools” - Pearson Education.
2. Holub - “Compiler Design in C” – PHI
3.Tremblay and Sorenson Compiler Writing-McgrawHill International .
4. Chattopadhyay , S- Compiler Design (PHI)

Computer Networks
Code: PCC-CS602
Contact Hours: 3L
Credit: 3

Pre-Requisite:- Basic knowledge of python (such as through Intro to Computer Science) is required. Basic search algorithms and a working knowledge of Linux and virtual machines.

Course Outcome: -

1. To develop an understanding of computer networking basics.
2. To develop an understanding of different components of computer networks, various protocols, modern technologies and their applications.

Topic:-

Module I

Overview of Data Communication and Networking:

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

Physical Level:

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

Module II

Data link Layer:

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

Medium Access sub layer:

Point to Point Protocol, LCP, NCP, Token Ring; Reservation, Polling, Multiple access protocols: Pure ALOHA, Slotted ALOHA, CSMA, CSMA/CD, CSMA/CA Traditional Ethernet, fast Ethernet(in brief);

Module III

Network layer:

Internetworking & devices: Repeaters, Hubs, Bridges, Switches, Router, Gateway; Addressing : IP addressing, subnetting; Routing : techniques, static vs. dynamic routing , Unicast Routing Protocols: RIP, OSPF, BGP; Other Procols: ARP, IP, ICMP, IPV6;.

Transport layer:

Process to Process delivery; UDP; TCP; Congestion Control: Open Loop, Closed Loop choke packets; Quality of service: techniques to improve QoS: Leaky bucket algorithm, Token bucket algorithm.

Module IV

Application Layer

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

Modern topics:

ISDN services & ATM, DSL technology, Cable Modem: Architecture & Operation in brief

Wireless LAN: IEEE 802.11, Introduction to blue-tooth.

Text Books:

1. B. A. Forouzan – "Data Communications and Networking (3rd Ed.) " – TMH
2. A. S. Tanenbaum – "Computer Networks (4th Ed.)" – Pearson Education/PHI

3. W. Stallings – "Data and Computer Communications (5th Ed.)" – PHI/ Pearson Education
4. Zheng & Akhtar, Network for Computer Scientists & Engineers, OUP
5. Black, Data & Computer Communication, PHI
6. Miller, data Communication & Network, Vikas

Computer Networks Laboratory
Code: PCC-CS692
Contact Hours: 2L
Credit: 2

Pre-Requisite:- Basic knowledge of python (such as through Intro to Computer Science) is required. Basic search algorithms and a working knowledge of Linux and virtual machines.

Course Outcome: -

After completing the course, students will be able to:

• Understand the structure and organization of computer networks; including the division into network layers, role of each layer, and relationships between the layers.

• Understand the basic concepts of application layer protocol design; including client/server models, peer to peer models, and network naming.

• In depth understanding of transport layer concepts and protocol design; including connection oriented and connection-less models, techniques to provide reliable data delivery and algorithms for congestion control and flow control.

Topic:-

- IPC (Message queue)
- NIC Installation & Configuration (Windows/Linux)
- Familiarization with
  - Networking cables (CAT5, UTP)
  - Connectors (RJ45, T-connector)
  - Hubs, Switches
- TCP/UDP Socket Programming
- Multicast & Broadcast Sockets

Implementation of a Prototype Multithreaded Server

- Implementation of
  - Data Link Layer Flow Control Mechanism (Stop & Wait, Sliding Window)
  - Data Link Layer Error Detection Mechanism (Cyclic Redundancy Check)
  - Data Link Layer Error Control Mechanism (Selective Repeat, Go Back N)

Text Books:

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

Cloud Computing & IoT
Code: PCC-CS603
Contact Hours: 2L
Credit: 2

Pre-Requisite:- Electronics,DBMS

Course Outcome: -

The main objective of this course is to introduce concepts related to the analysis, design and implementation of computation and storage clouds.
With the completion of the course, the student will be in position:
· to understand the necessary theoretical background for computing and storage, clouds environments.
· to know the methodologies and technologies for the development of applications that will be deployed and offered through cloud computing environments.
· to be able to realize cloud infrastructures by using IaaS software, while also developing cloud applications by utilizing PaaS software.

Topic:-

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

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

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

4. Concepts of Abstraction and Virtualization:
Virtualization technologies : Types of virtualization (access, application, CPU, storage), Mobility patterns (P2V, V2V, V2P, P2P, D2C, C2C, C2D, D2D)

5. Load Balancing and Virtualization:
Basic Concepts, Network resources for load balancing, Advanced load balancing (including Application Delivery Controller and Application Delivery Network), Mention of The Google Cloud as an example of use of load balancing Hypervisors: Virtual machine technology and types, VMware vSphere, Machine Imaging (including mention of Open Virtualization Format – OVF)

6. Porting of applications in the Cloud:
The simple Cloud API and AppZero Virtual Application appliance

7. Definition of services, Distinction between SaaS and PaaS (knowledge of Salesforce.com and Force.com), Application development, Use of PaaS Application frameworks

8. Use of Google Web Services:

Discussion of Google Applications Portfolio – Indexed search, Dark Web, Aggregation and disintermediation, Productivity applications and service, Adwords, Google Analytics, Google Translate, a brief discussion on Google Toolkit (including introduction of Google APIs in brief), major features of Google App Engine service.
Use of Amazon Web Services Amazon Web Service components and services: Amazon Elastic Cloud, Amazon Simple Storage system, Amazon Elastic Block Store, Amazon SimpleDB and Relational Database Service
Use of Microsoft Cloud Services Windows Azure platform: Microsoft's approach, architecture, and main elements, overview of Windows Azure AppFabric, Content Delivery Network, SQL Azure, and Windows Live services

9. Cloud Management:
An overview of the features of network management systems and a brief introduction of related products from large cloud vendors, Monitoring of an entire cloud computing deployment stack – an overview with mention of some products, Lifecycle management of cloud services (six stages of lifecycle), Concepts of Cloud Security, Cloud security concerns, Security boundary, Security service boundary, Overview of security mapping, Security of data: Brokered cloud storage access, Storage location and tenancy, encryption, and auditing and compliance, Identity management (awareness of Identity protocol standards)

10. Service Oriented Architecture:
Basic concepts of message-based transactions, Protocol stack for an SOA architecture, Event-driven SOA, Enterprise Service Bus, Service catalogs, Applications in the Cloud: Concepts of cloud transactions, functionality mapping, Application attributes, Cloud service attributes, System abstraction and Cloud Bursting, Applications and Cloud APIs, Cloud-based Storage: Cloud storage definition – Manned and Unmanned, Webmail Services: Cloud mail services including Google Gmail, Mail2Web, Windows Live Hotmail, Yahoo mail, concepts of Syndication services

Text Books:
1. Mastering Cloud Computing, 1st Edition, Foundations and Applications Programming, RajkumarBuyya, Christian Vecchiola, S.ThamaraiSelvi, McGraw Hill.
2. Cloud Computing Bible, Barrie Sosinsky, Wiley

Cloud Computing & IoT Laboratory
Code: PCC-CS693
Contact Hours: 2L
Credit: 1

Pre-Requisite:- Electronics,DBMS

Course Outcome: -

The main objective of this course is to introduce concepts related to the analysis, design and implementation of computation and storage clouds.
With the completion of the course, the student will be in position:
· to understand the necessary theoretical background for computing and storage, clouds environments.
· to know the methodologies and technologies for the development of applications that will be deployed and offered through cloud computing environments.
· to be able to realize cloud infrastructures by using IaaS software, while also developing cloud applications by utilizing PaaS software.

Topic:-
1. Creating a Warehouse Application in SalesForce.com.

2. Creating an Application in SalesForce.com using Apexprogramming Language.
3. Implementation of SOAP Web services in C#/JAVAApplications.
4. Implementation of Para-Virtualization using VM Ware‘sWorkstation/ Oracle‘s Virtual Box and Guest O.S.
5. Installation and Configuration of Hadoop.
6. Create an application (Ex: Word Count) using HadoopMap/Reduce.
7. Case Study: PAAS(Facebook, Google App Engine)
8. Case Study: Amazon Web Services.
9. Recapitulation of Python.
10. Study and Install IDE of Arduino and different types of Arduino.
11. Write program using Arduino IDE for Blink LED.
12. Write Program for RGB LED using Arduino.
13. Study the Temperature sensor and Write Program foe monitor temperature usingArduino.
14. Study and Implement RFID, NFC using Arduino.
15. Study and implement MQTT protocol using Arduino.
16. Study and Configure Raspberry Pi.
17. WAP for LED blink using Raspberry Pi.
18. Study and Implement Zigbee Protocol using Arduino / Raspberry Pi.

Text Books:

1. Mastering Cloud Computing, 1st Edition, Foundations and Applications Programming, RajkumarBuyya, Christian Vecchiola, S.ThamaraiSelvi, McGraw Hill.
2. Cloud Computing Bible, Barrie Sosinsky, Wiley

Professional Elective -II
Code: PEC-CS601
Contact Hours: 3L
Credit: 3

Option 1. Soft computing:

Pre-Requisite:- Artificial Intelligence

Course Outcome: -

1. Apply basics of Fuzzy logic and neural networks. Discuss the ideas of fuzzy sets, fuzzy logic and use of heuristics based on human experience
2. Relate with neural networks that can learn from available examples and generalize to form appropriate rules for inference systems
3. Describe with genetic algorithms and other random search procedures useful while seeking global optimum in self-learning situations
4. Develop some familiarity with current research problems and research methods in Soft Computing Techniques.

Topic:-

1**. Introduction to Soft Computing**

- Concept of computing systems.
- "Soft" compiting versus "Hard" computing
- Characteristics of Soft computing
- Some applications of Soft computing techniques

2. Fuzzy logic

- Introduction to Fuzzy logic.
- Fuzzy sets and membership functions.
- Operations on Fuzzy sets.
- Fuzzy relations, rules, propositions, implications and inferences.
- Defuzzification techniques.
- Fuzzy logic controller design.
- Some applications of Fuzzy logic.

3. Genetic Algorithms

- Concept of "Genetics" and "Evolution" and its application to proablistic search techniques
- Basic GA framework and different GA architectures.
- GA operators: Encoding, Crossover, Selection, Mutation, etc.
- Solving single-objective optimization problems using GAs.

4. Multi-objective Optimization Problem Solving

- Concept of multi-objective optimization problems (MOOPs) and issues of solving them.
- Multi-Objective Evolutionary Algorithm (MOEA).
- Non-Pareto approaches to solve MOOPs
- Pareto-based approaches to solve MOOPs
- Some applications with MOEAs.

5. Artificial Neural Networks

- Biological neurons and its working.
- Simulation of biolgical neurons to problem soloving.
- Different ANNs architectures.
- Training techniques for ANNs.
- Applications of ANNs to solve some real life problems.

Text Books:

1. Fuzzy Logic: A Pratical approach, F. Martin, , Mc neill, and Ellen Thro, AP Professional, 2000.
2. Fuzzy Logic with Engineering Applications (3rd Edn.), Timothy J. Ross, Willey, 2010.
3. Foundations of Neural Networks, Fuzzy Systems, and Knowldge Engineering, Nikola K. Kasabov, MIT Press, 1998.
4. Fuzzy Logic for Embedded Systems Applications, Ahmed M. Ibrahim, Elesvier Press, 2004.
5. An Introduction to Genetic Algorithms, Melanie Mitchell, MIT Press, 2000.
6. Genetic Algorithms In Search, Optimization And Machine Learning, David E. Goldberg, Pearson Education, 2002.
7. Practical Genetic Algorithms, Randy L. Haupt and sue Ellen Haupt, John Willey & Sons, 2002.

Option 2. Human Computer Interaction

Pre-Requisite:- 1. Programming in C or Any other language
2. Unix
3. Statistical Methods

Course Outcome: -

1. Understand the theoretical dimensions of human factors involved in the acceptance of computer interfaces.
2. Understand the important aspects of implementation of human-computer interfaces.
3. Identify the various tools and techniques for interface analysis, design, and evaluation.
4. Identify the impact of usable interfaces in the acceptance and performance utilization of information systems.

5. Identify the importance of working in teams and the role of each member within an interface development phase.

Topic:-

Unit 1: Introduction to Human Computer Interface

Importance of User Interface, History of Human Computer Interface, Importance of Good Design, Benefits of Good Design, Principles of User Interface Design.

Unit 2: Interaction Devices

Keyboard Keys, Function Keys, Pointing Devices, Speech Recognition, Handwriting Recognition, Speech Generation, Image Display, Video Display, Device Drivers.

Unit 3: Color and Content

Why Colors, Color Uses, Choosing Colors, Possible Problems With Colors, Page Title, Headings, Text, Messages, Error Messages, Icons.

Unit 4: User Interface Design Process-I

Understanding How User Interact With Computers, User Interface Models, Design Methodologies, Designing an Interface, Process of Interaction Design.

Unit 5: User Interface Design Process-II

Human Interaction with Computers, Human Interaction Speeds, Human Characteristics in Design, Human Consideration in Design.

Unit 6: Graphical User Interface

Popularity of Graphics, Characteristics of Graphical User Interface, Concepts of Direct Manipulation, Graphical System Advantages and Disadvantages, Web User Interface Characteristics and Popularity.

Unit 7: Device and Screen-Based Control

Device Based Controls, Operable Controls, Text Entry/Read-Only Controls, Selection Controls, Combining Entry/Selection Controls, Other Operable Controls, Presentation Controls and Selecting Proper Control

Unit 8: Screen Design

Design Goals, Test for a Good Design, Screen and Web Page Meaning and Purpose, Organizing Screen Elements Clearly, Ordering of Screen Data and Content, Screen Navigation and Flow.

Unit 9: Windows

Window characteristics, Components of Window, Window Presentation Styles, Types of Windows, Window Management.

Unit 10: Understanding Business Functions

Business Definitions and Requirement analysis, Determining Business Functions, Design Standards or Style Guides, System Training and Documentation.

Unit 11: Software Tools Specification Methods, Interface Building Tools-Interface Mock Up Tools, Software Engineering Tools, Windowing System Layer, GUI Tool Kit Layer.

Unit 12: Information Search and Visualization

Database Query, Phase Search in Documents, Multimedia Document Searches, Information Visualization, Advanced Filtering, Hypertext, Web Technology, Static Web Content and Dynamic Web Content.

Unit 13: Time

Response Time, Dealing With Time Delays, Echo Delay, File Delay, Blinking for Attention, Use of Sound, Preventing Errors

Unit 14: Usability and Prototypes

Usability: Purpose of Usability, Importance of Usability, Usability Testing.

Prototypes: Hand Sketches and Scenarios, Interactive Paper Prototypes, Programm Facades, Prototype-Oriented Languages, Comparisons of Prototypes.

Text Books:

1. Human-Computer Interaction, 3e, Dix, Pearson
2. Interaction Design: Beyond Human-Computer Interaction, Jenny Preece

3. Designing for Effective Human/Computer Interaction, Ben Shneiderman

Professional Elective -III
Code: PEC-CS602
Contact Hours: 3L
Credit: 3

Option 1. Data Analytics

Pre-Requisite:- 1. Knowledge of Boolean algebra, matrix, statistics.
2. Basic knowledge of programming in any language (PYTHON is preferable).
3. Knowledge of Database Management Systems.
4. Knowledge of flowchart, data-structure, algorithm, graph and tree.

Course Outcome: -
The main goal of this course is to help students learn, understand, and practice big data analytics and machine learning approaches, which include the study of modern computing big data technologies and scaling up machine learning techniques focusing on industry applications.
1. Mainly the course objectives are: conceptualization and summarization of big data and machine learning, trivial data versus big data, big data computing technologies, machine learning techniques, and scaling up machine learning approaches.

Topic:-
1. Descriptive Statistics Introduction to the course Descriptive Statistics Probability Distributions
2. Inferential Statistics Inferential Statistics through hypothesis tests Permutation & Randomization Test 3. Regression & ANOVA Regression ANOVA (Analysis of Variance)
4. Machine Learning: Introduction and Concepts Differentiating algorithmic and model based frameworks Regression : Ordinary Least Squares, Ridge Regression, Lasso Regression, K Nearest Neighbours Regression & Classification
5. Supervised Learning with Regression and Classification techniques -1 Bias-Variance Dichotomy. Model Validation Approaches Logistic Regression Linear Discriminant Analysis Quadratic Discriminant Analysis Regression and Classification Trees Support Vector Machines
6. Supervised Learning with Regression and Classification techniques -2 Ensemble Methods: Random Forest Neural Networks Deep learning
7. Unsupervised Learning and Challenges for Big Data Analytics Clustering Associative Rule Mining Challenges for big data analytics.
8. Prescriptive analytics Creating data for analytics through designed experiments Creating data for analytics through Active learning Creating data for analytics through Reinforcement learning.

Text Books:
1. "Probability" Jim Pitman. Springer
2. "Mathematics for Machine Learning" Faisal, Ong, Deisenroth. Cambridge University Press
3. Probability and Statistics for Computer Science, David Forsyth
4. “Statistics in a Nutshell” Boslaugh
5. "Python for Data Analysis" McKinney. O'Reilly
6. "Python Data Analytics" Nelli. Apress

7. “Data Analysis” Bishnu, Bhattacharjee
8. “Principles of Data Mining” Brammer
9. “Data Mining” Han, Kamber
10. “Data Mining” Tan, Kumar, Steinbach
11. An Introduction to Statistical Learning: With Applications in R, Gareth M. James, Trevor Hastie, Daniela Witten, R J Tibshirani
12. Beginning R: The Statistical Programming Language, Mark Gardener

Option 2. Blockchain Technology

Pre-Requisite:- PEC-CS501 : Cyber Security
Co-Requisite :- PCCCS602 :Computer Networks

Course Outcome: -

- Understand how blockchain systems (mainly Bitcoin and Ethereum) work,
- To securely interact with them,
- Design, build, and deploy smart contracts and distributed applications,
- Integrate ideas from blockchain technology into their own projects.

Topic:-

1. Introduction: Need for Distributed Record Keeping, Modeling faults and adversaries,Byzantine Generals problem,Consensus algorithms and their scalability problems,Why Nakamoto Came up with Blockchain based cryptocurrency? Technologies Borrowed in Blockchain – hash pointers, consensus, byzantine fault-tolerant distributed computing, digital cash etc.

2. Basic Distributed Computing: Atomic Broadcast, Consensus, Byzantine Models of fault tolerance

3. Basic Crypto primitives: Hash functions, Puzzle friendly Hash, Collison resistant hash, digital signatures, public key crypto, verifiable random functions, Zero-knowledge systems.

4. Blockchain 1.0: Bitcoin blockchain, the challenges, and solutions, proof of work, Proof of stake, alternatives to Bitcoin consensus, Bitcoin scripting language and their use.

5. Blockchain 2.0: Ethereum and Smart Contracts, The Turing Completeness of Smart Contract Languages and verification challenges, Using smart contracts to enforce legal contracts, comparing Bitcoin scripting vs. Ethereum Smart Contracts.

6. Blockchain 3.0 : Hyperledger fabric, the plug and play platform and mechanisms in permissioned blockchain

7. Privacy, Security issues in Blockchain: Blockchain: Pseudo-anonymity vs. anonymity, Zcash and Zk-SNARKS for anonymity preservation, attacks on Blockchains – such as Sybil attacks, selfish mining, 51% attacks - -advent of algorand, and Sharding based consensus algorithms to prevent these.

Text Books:

1. Draft version of “S. Shukla, M. Dhawan, S. Sharma, S. Venkatesan, ‘Blockchain Technology: Cryptocurrency and Applications’, Oxford University Press, 2019.

2. Josh Thompson, 'Blockchain: The Blockchain for Beginnings, Guild to Blockchain Technology and Blockchain Programming', Create Space Independent Publishing Platform, 2017.
3. "The Basics of Bitcoins and Blockchains" by Antony Lewis
4. "The Internet of Money, Volumes 1 - 3" by Andreas Antonopoulos

Open Elective -I
Code: OEC-CS601
Contact Hours: 3L
Credit: 3

Human Resource Development and Organizational Behavior

Pre-Requisite:- Basic knowledge of management is helpful, Case study videos.

Course Outcome: -

Learn about organizations, their structure, purpose and theories concerning organizations.
· Understand employee behavioural dynamics in organizations.
· Understand individual and group behaviours in organizational context
· Learn about developmental aspect of human resources.
· Learn the fundamentals of team building, organizational culture building, competency building
· Develop concepts on Human Capital.

Topic:-

1. Organizational Behaviour: Definition, Importance, Historical Background, Fundamental Concepts of OB, Challenges and Opportunities for OB.
2. Personality and Attitudes: Meaning of personality, Personality Determinants and Traits, Development of Personality, Types of Attitudes, Job Satisfaction.
3. Perception: Definition, Nature and Importance, Factors influencing Perception, Perceptual Selectivity, Link between Perception and Decision Making.
4. Motivation: Definition, Theories of Motivation - Maslow's Hierarchy of Needs Theory, McGregor's Theory X & Y, Herzberg's Motivation-Hygiene Theory, Alderfer's ERG Theory, McClelland's Theory of Needs, Vroom's Expectancy Theory.
5. Group Behaviour: Characteristics of Group, Types of Groups, Stages of Group Development, Group Decision Making.
6. Communication: Communication Process, Direction of Communication, Barriers to Effective Communication.
7. Leadership: Definition, Importance, Theories of Leadership Styles.
8. Organizational Politics: Definition, Factors contributing to Political Behaviour.
9. Conflict Management: Traditional vis-a-vis Modern View of Conflict, Functional and Dysfunctional Conflict, Conflict Process, Negotiation – Bargaining Strategies, Negotiation Process.
10. Organizational Design: Various Organizational Structures and their Effects on Human Behaviour, Concepts of Organizational Climate and Organizational Culture.

Text Books:

1. Robbins, S. P. & Judge, T.A.: Organizational Behavior, Pearson Education, 15th Edn.
2. Luthans, Fred: Organizational Behavior, McGraw Hill, 12th Edn.
3. Shukla, Madhukar: Understanding Organizations – Organizational Theory & Practice in India, PHI
4. Fincham, R. & Rhodes, P.: Principles of Organizational Behaviour, OUP, 4th Edn.

Hersey, P., Blanchard, K.H., Johnson, D.E.- Management of Organizational Behavior Leading Human Resources, PHI, 10th Edn.

Universal Human Values – VI
Code: HSMC602
Contact Hours: 3L
Credit: 3

Pre-Requisite:- A student is required to possess a basic knowledge various subjects related to Engineering and Science along with the awareness of current national and international happenings. He/she should be aware of the types of questions being asked in GATE examination.

Course Outcome: -

1. This subject is taught to polish and enhance various aptitude skills and cognitive knowledge of the students and prepare them to be successful in the fields different competitive examinations like GATE,CAT, MAT,GMAT,UPSC, WBCS, Banking services, Indian Defence Services ,Combined Graduate Level etc.
2. This way our students are trained not only for private sectors but also for public sectors to secure a fulfilling career.

Topic:

1. Questions from GATE to be solved by students. (6000 + questions).
2. NET equivalent examinations related questions to be solved from engineering domain.
3. CAT previous years question solved.
4. Banking Services questions solved.

Text Books: NONE

Mandatory Additional Requirements (MAR)
Code: MC681
Credit: 0

Innovative Project – IV
Code:PROJ-CS601
Contact Hours: 3L
Credit: 3

Massive Open Online Courses (Mandatory for B.Tech (Honours))
Course Code: MOOC 6
Credit:1.5

B.Tech 4th Year 7th Semester

Network Security & Cryptography
Code:PCC-CS701
Contact Hours: 2L
Credit: 2

Pre-Requisite:-

- Fundamentals of Mathematics, algebra, calculus etc., Computer Networks

Course Outcome: –

Completion of this course will enable the students to:
• Describe network security services and mechanisms.
• Symmetrical and Asymmetrical cryptography.
• Data integrity, Authentication, Digital Signatures.
• Various network security applications, IPSec, Firewall, IDS, Web security, Email security, and Malicious software etc.

Topic: -

UNIT I Introduction

Introduction to the Concepts of Cryptography & Security: The need for security, Security Approaches, Principles of Security, Types of Attacks. Cryptographic Techniques: Plain Text and Cipher Text, Classical Encryption Techniques, Substitution Techniques, Transposition Techniques, Encryption and Decryption, Symmetric and Asymmetric Key Cryptography, Steganography, Key Range and Key Size, Possible Types of Attacks.

UNIT II Symmetric Key Cryptography

Diffie-Hellman key Exchange – Algorithm, Key Exchange Protocols and Man-in-the-Middle protocol. Computer-based Symmetric Key Cryptographic Algorithms: Algorithm Types and Modes, An overview of Symmetric Key Cryptography, DES, International Data Encryption Algorithm (IDEA), RC5, Blowfish, AES, Differential and Linear Cryptanalysis.

UNIT III Asymmetric Key Algorithm & Authentication And Hash Function

Asymmetric Key Algorithm, Digital Signature and RSA Introduction: Overview of Asymmetric key Cryptography, RSA algorithm, Symmetric & Asymmetric key Cryptography together, Digital Signature, Basic concepts of Message Digest and Hash Function (Algorithms on Message Digest and Hash function not required), Secure Hash Algorithm – SHA-512 Logic and Round Function.

UNIT IV Network Security

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

Text Book:

1. William Stallings, “Cryptography and Network Security – Principles and Practices”, Pearson Education, Third Edition, 2003.
2. Behrouz A. Foruzan, “Cryptography and Network Security”, Tata McGraw-Hill, 2007.
3. Bruce Schneier, “Applied Cryptography”, John Wiley & Sons Inc, 2001.
4. Charles B. Pfleeger, Shari Lawrence Pfleeger, “Security in Computing”, Third Edition, Pearson Education, 2003.
5. Wade Trappe and Lawrence C. Washington, “Introduction to Cryptography with coding theory”, Pearson Education, 2007.
6. Wenbo Mao, “Modern Cryptography Theory and Practice”, Pearson Education, 2007.

7. Thomas Calabrese, “Information Security Intelligence : Cryptographic Principles and Applications”, Thomson Delmar Learning, 2006.
8. AtulKahate, “Cryptography and Network Security”, Tata McGraw-Hill, 2003.

Professional Elective – IV
Code: PEC-CS701
Contact Hours: 3L
Credit: 3

Option – 1. Speech and Natural Language Processing

Pre-Requisite:-

- Formal Language & Automata Theory, PCC-CS502, Artificial Intelligence & Machine Learning, PCC-CS405

Course Outcome: -

1. To develop ability to pre-process natural language
2. To develop an understanding of different feature extraction techniques in NLP
3. To develop skill to solve complex problems associated with NLP

Topic: -

1. Introduction: Origins and challenges of NLP – Language Modeling:
Grammar-based LM, Statistical LM – Regular Expressions, Finite-State Automata – English Morphology, Transducers for lexicon and rules, Tokenization, Detecting and Correcting Spelling Errors, Minimum Edit Distance

2. Word Level Analysis:
Unsmoothed N-grams, Evaluating N-grams, Smoothing, Interpolation and Backoff – Word Classes, Part-of-Speech Tagging, Rule-based, Stochastic and Transformation-based tagging, Issues in PoS tagging – Hidden Markov and Maximum Entropy models

3. Syntactic Analysis:
Context-Free Grammars, Grammar rules for English, Treebanks, Normal Forms for grammar – Dependency Grammar – Syntactic Parsing, Ambiguity, Dynamic Programming parsing – Shallow parsing – Probabilistic CFG, Probabilistic CYK, Probabilistic Lexicalized CFGs – Feature structures, Unification of feature structures.

4. Semantics and Pragmatics:
Requirements for representation, First-Order Logic, Description Logics – Syntax-Driven Semantic analysis, Semantic attachments – Word Senses, Relations between Senses, Thematic Roles, selectional restrictions – Word Sense Disambiguation, WSD using Supervised, Dictionary & Thesaurus, Bootstrapping methods – Word Similarity using Thesaurus and Distributional methods.

5. Discourse Analysis And Lexical Resources:
Discourse segmentation, Coherence – Reference Phenomena, Anaphora Resolution using Hobbs and Centering Algorithm – Coreference Resolution – Resources: Porter Stemmer, Lemmatizer, Penn Treebank, Brill’s Tagger, WordNet, PropBank, FrameNet, Brown Corpus, British National Corpus (BNC).

Text Books:

1. Daniel Jurafsky, James H. Martin―Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech, Pearson Publication, 2014.
2. Steven Bird, Ewan Klein and Edward Loper, ―Natural Language Processing with Python, First Edition, OReilly Media, 2009.

Option – 2. Embedded Systems

Pre-Requisite:-

1. Assembly language concepts
2. Operating system concepts
3. Computer organization and architecture concepts
4. Design analysis of different day to day equipments

Course Outcome: -

1. Students have knowledge about the basic functions, structure, concepts and applications of embedded systems.
2. To learn the method of designing and program an Embedded Systems for real time applications.
3. To understand operating system concepts and types.
4. Students have knowledge about basic communication protocols.
5. To understand different concepts of a RTOS, sensors, memory interface, communication interface.

Topic: -

Module 1

Core of the embedded system, Memory, Sensors (resistive, optical, position, thermal) and Actuators (solenoid valves, relay/switch, opto-couplers), Communication Interface, Embedded firmware (RTOS, Drivers, Application programs), Power-supply (Battery technology, Solar), PCB and Passive components, Safety and reliability, environmental issues.Ethical practice. Characteristics and quality attributes (Design Metric) of embedded system. Real time system's requirements, real time issues, interrupt latency. Embedded Product development life cycle, Program modeling concepts: DFG, FSM, Petri-net, UML

Module 2

Introduction to ARM-v7-M (Cortex-M3), ARM-v7-R (CortexR4) and comparison in between them.Introduction to ARM-v7-M (Cortex-M3), ARM-v7-R (CortexR4) and comparison in between them.

Module 3

Embedded Serial communication, Study of basic communication protocols like SPI, SCI (RS232, RS485), I2C, 10 CAN, Field-bus (Profibus), USB (v2.0), Bluetooth, Zig-Bee, Wireless sensor network

Module 4

Real time operating system: POSIX Compliance , Need of RTOS in Embedded system software, Foreground/Background systems, multitasking, context switching, IPC, Scheduler policies, Architecture of kernel, task scheduler, ISR, Semaphores, mailbox, message queues, pipes, events, timers, memory management, RTOS services in contrast with traditional OS.

Text Books:

1. Introduction to Embedded Systems :Shibu K. V. (TMH)
2. Embedded System Design – A unified hardware and software introduction: F. Vahid (John Wiley)
3. Embedded Systems :Rajkamal (TMH)
4. Embedded Systems : L. B. Das (Pearson)

Professional Elective – V
Code: PEC-CS702
Contact Hours: 3L
Credit: 3

Option – 1. Image Processing

Pre-Requisite:-

1. Knowledge of 12th standard mathematics.
2. Basic knowledge of Laplace and Fourier transform.
3. Basic knowledge of statistics.
4. Knowledge of Digital Electronics.
5. Knowledge of flowchart, data-structure, algorithm, graph and tree.

Course Outcome: -

1. To introduce the concepts of image processing and basic analytical methods to be used in image processing.
2. To familiarize students with image enhancement and restoration techniques, to explain different image compression techniques.
3. To introduce segmentation and morphological processing techniques.

Topic: -

Introduction

Background, Digital Image Representation, Fundamental steps in Image Processing, Elements of Digital Image Processing - Image Acquisition, Storage, Processing, Communication, Display.

Digital Image Formation

A Simple Image Model, Geometric Model- Basic Transformation (Translation, Scaling, Rotation), Perspective Projection, Sampling & Quantization - Uniform & Non uniform.

Mathematical Preliminaries

Neighbour of pixels, Connectivity, Relations, Equivalence & Transitive Closure; Distance Measures, Arithmetic/Logic Operations, Fourier Transformation, Properties of The Two Dimensional Fourier Transform, Discrete Fourier Transform, Discrete Cosine & Sine Transform.

Image Enhancement

Spatial Domain Method, Frequency Domain Method, Contrast Enhancement -Linear & Nonlinear Stretching, Histogram Processing; Smoothing - Image Averaging, Mean Filter, Low-pass Filtering; Image Sharpening. High-pass Filtering, High-boost Filtering, Derivative Filtering, Homomorphic Filtering; Enhancement in the frequency domain - Low pass filtering, High pass filtering.

Image Restoration

Degradation Model, Discrete Formulation, Algebraic Approach to Restoration - Unconstrained & Constrained; Constrained Least Square Restoration, Restoration by Homomorphic Filtering, Geometric Transformation - Spatial Transformation, Gray Level Interpolation.

Image Segmentation

Point Detection, Line Detection, Edge detection, Combined detection, Edge Linking & Boundary Detection - Local Processing, Global Processing via The Hough Transform; Thresholding - Foundation, Simple Global Thresholding, Optimal Thresholding; Region Oriented Segmentation - Basic Formulation, Region Growing by Pixel Aggregation, Region Splitting & Merging.

Text Books:

1. Digital Image Processing, Gonzalves,Pearson
2. Digital Image Processing, Jahne, Springer India
3. Digital Image Processing &Analysis,Chanda&Majumder,PHI
4. Fundamentals of Digital Image Processing, Jain, PHI
5. Image Processing, Analysis & Machine Vision, Sonka, VIKAS
6. Getting Started with GIS- Clarke Keith. C; PE.
7. Concepts & Techniques of GIS - Lo C.P, Albert, Yeung K.W- PHI.

Option – 2.Digital Forensics

Pre-Requisite:-

Cyber Security

Course Outcome: -

Having studied this course, students are expected to be to:

1. Define computer forensics.
2. Identify the process in taking digital evidence.
3. Describe how to conduct an investigation using methods of memory, operating system, network and email forensics.
4. Assess the different forensics tools.
5. Differentiate among different types of security attacks.
6. Describe the concept of ethical hacking.

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Topic: -

Module 1. Computer forensics fundamentals, Benefits of forensics, computer crimes, computer forensics evidence and courts, legal concerns and private issues.

Module 2. Understanding Computing Investigations – Procedure for corporate High-Tech investigations, understanding data recovery work station and software, conducting and investigations.

Module 3. Data acquisition- understanding storage formats and digital evidence, determining the best acquisition method, acquisition tools, validating data acquisitions, performing RAID data acquisitions, remote network acquisition tools, other forensics acquisitions tools.

Module 4. Processing crimes and incident scenes, securing a computer incident or crime, seizing digital evidence at scene, storing digital evidence, obtaining digital hash, reviewing case.

Module 5. Current computer forensics tools- software, hardware tools, validating and testing forensic software, addressing data-hiding techniques, performing remote acquisitions, E-Mail investigations-investigating email crime and violations, understanding E-Mail servers, specialized E-Mail forensics tool.

Text Books:

1. Warren G. Kruse II and Jay G. Heiser, "Computer Forensics: Incident Response Essentials", Addison Wesley, 2002.
2. Nelson, B, Phillips, A, Enfinger, F, Stuart, C., "Guide to Computer Forensics and Investigations, 2nd ed., Thomson Course Technology, 2006, ISBN: 0-619-21706-5.
3. Vacca, J, Computer Forensics, Computer Crime Scene Investigation, 2nd Ed, Charles River Media, 2005, ISBN: 1-58450-389.

Open Elective - II
Code:OEC-CS701
Contact Hours: 3L
Credit: 3

Option – 1. Cyber Security

Pre-Requisite:-

- No Pre-requisite or co-requisite is required for this subject.

Course Outcome: -

1. Analyze and evaluate the cyber security needs of an organization.
2. Conduct a cyber security risk assessment.

3. Measure the performance and troubleshoot cyber security systems.
4. Implement cyber security solutions.
5. Be able to use cyber security, information assurance, and cyber/computer forensics software/tools.

Topic: -

Module-1:

1. Introduction to Cyber Space. History of Internet , Cyber Crime , Information Security , Computer Ethics and Security Policies, Choosing the Best Browser according to the requirement and email security: Guidelines to choose web browsers , Securing web browser, Antivirus, Email security

2. Guidelines for secure password and wi-fi security, Guidelines for setting up a Secure password, Two-steps authentication, Password Manager, Wi-Fi Security

Module-2:

1. Guidelines for social media and basic Windows security, Guidelines for social media security, Tips and best practices for safer Social Networking, Basic Security for Windows, User Account Password, Smartphone security guidelines

2. Introduction to mobile phones, Smartphone Security, Android Security, IOS Security, Cyber Security Initiatives in India, Counter Cyber Security Initiatives in India, Cyber Security Exercise, Cyber Security, Incident Handling , Cyber Security Assurance

Module-3:

1. Online Banking, Credit Card and UPI Security, Online Banking Security, Mobile Banking Security, Security of Debit and Credit Card, UPI Security

2. Micro ATM, e-wallet and POS Security, Security of Micro ATMs, e-wallet Security Guidelines, Security Guidelines for Point of Sales(POS).

Module-4:

1. Social Engineering, Types of Social Engineering, How Cyber Criminal Works, How to prevent for being a victim of Cyber Crime, Cyber Security Threat Landscape and Techniques, Cyber Security Threat Landscape

Emerging Cyber Security Threats, Cyber Security Techniques, Firewall

2. IT Security Act and Misc. Topic, IT Act, Hackers-Attacker-Countermeasures, Web Application Security

Digital Infrastructure Security, Defensive Programming, Information Destroying and Recovery Tools, Recovering from Information Loss, Destroying Sensitive Information, CCleaner for Windows

Text Books:

1. Introduction to Cyber Security available at http://uou.ac.in/foundation-course
2. Fundamentals of Information Security http://uou.ac.in/progdetail?pid=CEGCS-17
3. Cyber Security Techniques http://uou.ac.in/progdetail?pid=CEGCS-17
4. Cyber Attacks and Counter Measures: User Perspective http://uou.ac.in/progdetail?pid=CEGCS-17
5. Information System http://uou.ac.in/progdetail?pid=CEGCS-17

<u>Option 2. Data Analytics</u>

Pre-Requisite:-

1. Knowledge of Boolean algebra, matrix, statistics.
2. Basic knowledge of programming in any language (PYTHON is preferable).
3. Knowledge of Database Management Systems.
4. Knowledge of flowchart, data-structure, algorithm, graph and tree.

Course Outcome: -

1. The main goal of this course is to help students learn, understand, and practice big data analytics and machine learning approaches, which include the study of modern computing big data technologies and scaling up machine learning techniques focusing on industry applications.
2. Mainly the course objectives are: conceptualization and summarization of big data and machine learning, trivial data versus big data, big data computing technologies, machine learning techniques, and scaling up machine learning approaches.

Topic:-

Module-1: Descriptive Statistics Introduction to the course Descriptive Statistics Probability Distributions
Module-2: Inferential Statistics Inferential Statistics through hypothesis tests Permutation & Randomization Test
Module-3: Regression & ANOVA Regression ANOVA (Analysis of Variance)
Module-4: Machine Learning: Introduction and Concepts Differentiating algorithmic and model based frameworks Regression : Ordinary Least Squares, Ridge Regression, Lasso Regression, K Nearest Neighbours Regression & Classification
Module-5: Supervised Learning with Regression and Classification techniques -1 Bias-Variance Dichotomy. Model Validation Approaches Logistic Regression Linear Discriminant Analysis Quadratic Discriminant Analysis Regression and Classification Trees Support Vector Machines
Module-6: Supervised Learning with Regression and Classification techniques -2 Ensemble Methods: Random Forest Neural Networks Deep learning
Module-7: Unsupervised Learning and Challenges for Big Data Analytics Clustering Associative Rule Mining Challenges for big data analytics.
Module-8: Prescriptive analytics Creating data for analytics through designed experiments Creating data for analytics through Active learning Creating data for analytics through Reinforcement learning.

Text Books:

1. "Probability" Jim Pitman. Springer
2. "Mathematics for Machine Learning" Faisal, Ong, Deisenroth. Cambridge University Press
3. Probability and Statistics for Computer Science, David Forsyth
4. “Statistics in a Nutshell” Boslaugh
5. "Python for Data Analysis" McKinney. O'Reilly
6. "Python Data Analytics" Nelli. Apress
7. “Data Analysis” Bishnu, Bhattacharjee
8. “Principles of Data Mining” Brammer
9. “Data Mining” Han, Kamber
10. “Data Mining” Tan, Kumar, Steinbach

Universal Human Values – VII
Code: HSMC702
Contact Hours: 3L
Credit: 3

Pre-Requisite:-

A student is required to possess a basic knowledge various subjects related to Engineering and Science along with the awareness of current national and international happenings. He/she should be aware of the types of questions being asked in GATE examination.

Course Outcome: -

1. This subject is taught to polish and enhance various aptitude skills and cognitive knowledge of the students and prepare them to be successful in the fields different competitive examinations like GATE,CAT, MAT,GMAT,UPSC, WBCS, Banking services, Indian Defence Services ,Combined
Graduate Level etc.

2. This way our students are trained not only for private sectors but also for public sectors to secure a fulfilling career.

Topic:
1. Questions from GATE to be solved by students. (6000 + questions).
2. NET equivalent examinations related questions to be solved from engineering domain.
3. CAT previous years question solved.
4. Banking Services questions solved.

Text Books: NONE

Mandatory Additional Requirements (MAR)
Code: MC781
Credit: 0

Innovative Project -V / Entrepreneurship
Code:PROJ-CS701
Contact Hours: 6L
Credit: 6

Massive Open Online Courses (Mandatory for B.Tech (Honours))
Code: MOOC 7
Credit: 5

B.Tech 4th Year 8th Semester

Professional Elective – V I
Code: PEC-CS801
Contact Hours: 3L
Credit: 3

Option 1. Quantum Computing

Pre-Requisite:- i) Basic understanding of quantum mechanics.
ii) Understanding of linear algebra and a basic of algorithms, cryptography.

Course Outcome: -
1. Students are able to understand the basic principles of quantum computing.
2. Students are capable to find the fundamental differences between conventional computing and quantum computing.
3. Students are get to know some basic quantum computing algorithms.
4. Students are able to learn different quantum information theory and quantum cryptography techniques.
5. Students are able to find out the classes of problems that can be expected to be solved well by quantum computers.

Topic:-
Module 1
Introduction to Quantum Computation: Quantum bits, Bloch sphere representation of a qubit, multiple qubits.

Module 2
Background Mathematics and Physics: Hilber space, Probabilities and measurements, entanglement, density operators and correlation, basics ofquantum mechanics, Measurements in bases other than computational basis.

Module 3
Quantum Circuits: single qubit gates, multiple qubit gates, design of quantum circuits.

Module 4
Quantum Information and Cryptography: Comparison between classical andquantum information theory. Bell states.Quantum teleportation.Quantum Cryptography, no cloning theorem.

Module 5
Quantum Algorithms: Classical computation on quantum computers.
Relationship between quantum and classical complexity classes.Deutsch's algorithm, Deutsch's-Jozsa algorithm, Shor factorization, Grover search.

Module 6
Noise and error correction: Graph states and codes, Quantum error correction, fault-tolerant computation.

Text Books:
1. Nielsen M. A., Quantum Computation and Quantum Information,Cambridge University Press.
2. Benenti G., Casati G. and Strini G., Principles of Quantum Computation and Information, Vol. I: Basic Concepts, Vol II: Basic Tools and Special Topics, World Scientific.
3. Pittenger A. O., An Introduction to Quantum Computing Algorithms

Option 2. Cyber Law , IPR & Ethics

Pre-Requisite:- Cyber Security

Course Outcome: -

1. Student will be able to make Learner Conversant with the social and intellectual property issues emerging from 'cyberspace.
2. Student will be able to explore the legal and policy developments in various Countries to regulate cyberspace;
3. Student will be able to develop process to file an IPR application
4. Student will be able to implement cyber security
5. Student will be able to suggest legal action to be taken against the cyber crimes
6. Develop the understanding of relationship between commerce and cyberspace; and
7. Give learners in depth knowledge of information technology Act and legal frame work of right to privacy, data security and data protection.

Topic:-

Module 1

Introduction to cyber law Evolution of computer Technology, emergence of cyber space. Cyber Jurisprudence, Jurisprudence and law, Doctrinal approach, Consensual approach, Real Approach, Cyber Ethics, Cyber Jurisdiction, Cyber Laws of other countries: EU GDPR, PIPEDA (Canada), etc.

Module 2

Information technology Act Overview of IT Act, 2000, Amendments in 2008/2013 and Limitations of ITAct, Legal Recognition of Electronic Records, Legal Recognition of Digital Signature, Certifying Authorities, Cyber Crime and Offences, Network Service Providers Li- ability

Module3

Cyber law and related Legislation Patent Law, Trademark Law, Copyright, Software Copyright or Patented, Do- main Names and Copyright disputes, Electronic Data Base and its Protection, IT Act and Civil Procedure Code, IT Act and Criminal Procedural Code, Relevant Sections of Indian Evidence Act, Relevant Sections of Bankers Book Evidence Act, Relevant Sections of Indian Penal Code, Relevant Sections of Reserve Bank of India Act, Law Relating To Employees And Internet, Alternative Dispute Resolution, Online Dispute Resolution (ODR).

Module4

Electronic Business and legal issues Legal issues in Evolution and development in E-commerce, paper vs paper less contracts E-Commerce models- B2B, B2C,E security

Module5

Application area Business, taxation, electronic payments, supply chain, EDI, E-markets, Emerging Trends

Text Books:

1. Cyber Law & Cyber Crimes By AdvocatPrashant Mali; Snow White publications, Mumbai
2. Cyber Law in India by Farooq Ahmad; Pioneer Books
3. Information Technology Law and Practice by Vakul Sharma; Universal Law Publishing Co. Pvt. Ltd.
4. The Indian Cyber Law by Suresh T. Vishwanathan; Bharat Law House New Delhi
5. Guide to Cyber and E – Commerce Laws by P.M. Bukshi and R.K. Suri; Bharat Law

Open Elective - III
Code:OEC-CS801
Contact Hours: 3L
Credit: 3

Option 1. Cyber Law , IPR & Ethics

Pre-Requisite:- Cyber Security

Course Outcome: -

1. Student will be able to make Learner Conversant with the social and intellectual property issues emerging from 'cyberspace.
2. Student will be able to explore the legal and policy developments in various Countries to regulate cyberspace;
3. Student will be able to develop process to file an IPR application
4. Student will be able to implement cyber security
5. Student will be able to suggest legal action to be taken against the cyber crimes
6. Develop the understanding of relationship between commerce and cyberspace; and
7. Give learners in depth knowledge of information technology Act and legal frame work of right to privacy, data security and data protection.

Topic:-

Module 1

Introduction to cyber law Evolution of computer Technology, emergence of cyber space. Cyber Jurisprudence, Jurisprudence and law, Doctrinal approach, Consensual approach, Real Approach, Cyber Ethics, Cyber Jurisdiction, Cyber Laws of other countries: EU GDPR, PIPEDA (Canada), etc.

Module 2

Information technology Act Overview of IT Act, 2000, Amendments in 2008/2013 and Limitations of ITAct, Legal Recognition of Electronic Records, Legal Recognition of Digital Signature, Certifying Authorities, Cyber Crime and Offences, Network Service Providers Li- ability

Module3

Cyber law and related Legislation Patent Law, Trademark Law, Copyright, Software Copyright or Patented, Do- main Names and Copyright disputes, Electronic Data Base and its Protection, IT Act and Civil Procedure Code, IT Act and Criminal Procedural Code, Relevant Sections of Indian Evidence Act, Relevant Sections of Bankers Book Evidence Act, Relevant Sections of Indian Penal Code, Relevant Sections of Reserve Bank of India Act, Law Relating To Employees And Internet, Alternative Dispute Resolution, Online Dispute Resolution (ODR).

Module4

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Application area Business, taxation, electronic payments, supply chain, EDI, E-markets, Emerging Trends

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3. Information Technology Law and Practice by Vakul Sharma; Universal Law Publishing Co. Pvt. Ltd.
4. The Indian Cyber Law by Suresh T. Vishwanathan; Bharat Law House New Delhi
5. Guide to Cyber and E – Commerce Laws by P.M. Bukshi and R.K. Suri; Bharat Law

Option – 2. Neural Networks and Deep Learning

Pre-Requisite:- Mathematics (Linear Algebra, Vector Calculus, Probability), Machine Learning

Course Outcome: -

1. Model Neuron and Neural Network, and to analyze ANN learning, and its applications.
2. Perform Pattern Recognition, Linear classification.
3. Develop different single layer/multiple layer Perception learning algorithms
4. Design of another class of layered networks using deep learning principles.

Topic: -

Module -1:

1. Fundamentals of Neural Network & Deep Learning:

Challenges in shallow network; Motivation for deep neural network, Different deep neural network architectures – Perceptron, Feedforward network, etc. Forward and backward propagation, Gradient Descent and related problems, Regularization, Batch normalization, Optimization algorithms (Adam's, RMSprop, etc.), Hyperparameters

Module -2:

1. Convolutional Neural Network:

Foundational concepts of CNN, Building a CNN architecture, Popular CNN architectures – LeNet, AlexNet, ResNet, CNN applications

Module -3:

1. Recurrent Neural Network:

Sequence data, Architecture of RNN, Long Short Term Memory (LSTM),Bi-directional LSTM, Gated Recurrent Unit (GRU),Applications of RNN

Module -4:

1. Important deep learning frameworks: Tensorflow 2.0, Keras, PyTorch, Theano, Caffe

Text Books:

1. Ian Goodfellow, YoshuaBengio, Aaron Courville, Francis Bach, Deep Learning, The MIT Press.
2. Fundamentals of Deep Learning – by Nikhil Buduma (O'Reilly).
3. Deep Learning – A practitioner's approach – by Josh Patterson & Adam Gibson (O'Reilly).

Open Elective - IV
Code:OEC-CS802
Contacts: 3L
Credit: 3

<u>Option – 1.Digital Forensics</u>

Pre-Requisite:- Cyber Security

Course Outcome: -

Having studied this course, students are expected to be to:

1. Define computer forensics.
2. Identify the process in taking digital evidence.
3. Describe how to conduct an investigation using methods of memory, operating system, network and email forensics.
4. Assess the different forensics tools.
5. Differentiate among different types of security attacks.
6. Describe the concept of ethical hacking.

Topic: -

Module -1:

Computer forensics fundamentals, Benefits of forensics, computer crimes, computer forensics evidence and courts, legal concerns and private issues.

Module -2:

Understanding Computing Investigations – Procedure for corporate High-Tech investigations, understanding data recovery work station and software, conducting and investigations.

Module -3:

Data acquisition- understanding storage formats and digital evidence, determining the best acquisition method, acquisition tools, validating data acquisitions, performing RAID data acquisitions, remote network acquisition tools, other forensics acquisitions tools.

Module -4:

Processing crimes and incident scenes, securing a computer incident or crime, seizing digital evidence at scene, storing digital evidence, obtaining digital hash, reviewing case.

Module -5:

Current computer forensics tools- software, hardware tools, validating and testing forensic software, addressing data-hiding techniques, performing remote acquisitions, E-Mail investigations- investigating email crime and violations, understanding E-Mail servers, specialized E-Mail forensics tool.

Text Books:

1. Warren G. Kruse II and Jay G. Heiser, "Computer Forensics: Incident Response Essentials", Addison Wesley, 2002.
2. Nelson, B, Phillips, A, Enfinger, F, Stuart, C., "Guide to Computer Forensics and Investigations, 2nd ed., Thomson Course Technology, 2006, ISBN: 0-619-21706-5.
3. Vacca, J, Computer Forensics, Computer Crime Scene Investigation, 2nd Ed, Charles River Media, 2005, ISBN: 1-58450-389.

Option 2. Quantum Computing

Pre-Requisite:- i) Basic understanding of quantum mechanics.
ii) Understanding of linear algebra and a basic of algorithms, cryptography.

Course Outcome: -

1. Students are able to understand the basic principles of quantum computing.
2. Students are capable to find the fundamental differences between conventional computing and quantum computing.
3. Students are get to know some basic quantum computing algorithms.
4. Students are able to learn different quantum information theory and quantum cryptography techniques.
5. Students are able to find out the classes of problems that can be expected to be solved well by quantum computers.

Topic:-

Module 1

Introduction to Quantum Computation: Quantum bits, Bloch sphere representation of a qubit, multiple qubits.

Module 2
Background Mathematics and Physics: Hilber space, Probabilities and measurements, entanglement, density operators and correlation, basics ofquantum mechanics, Measurements in bases other than computational basis.

Module 3
Quantum Circuits: single qubit gates, multiple qubit gates, design of quantum circuits.

Module 4
Quantum Information and Cryptography: Comparison between classical andquantum information theory. Bell states.Quantum teleportation.Quantum Cryptography, no cloning theorem.

Module 5
Quantum Algorithms: Classical computation on quantum computers.
Relationship between quantum and classical complexity classes.Deutsch's algorithm, Deutsch's-Jozsa algorithm, Shor factorization, Grover search.

Module 6
Noise and error correction: Graph states and codes, Quantum error correction, fault-tolerant computation.

Text Books:
1. Nielsen M. A., Quantum Computation and Quantum Information,Cambridge University Press.
2. Benenti G., Casati G. and Strini G., Principles of Quantum Computation and Information, Vol. I: Basic Concepts, Vol II: Basic Tools and Special Topics, World Scientific.
3. Pittenger A. O., An Introduction to Quantum Computing Algorithms

Universal Human Values – VIII
Code: HSMC802
Contacts: 3L
Credit: 3

Pre-Requisite:-
A student is required to possess a basic knowledge various subjects related to Engineering and Science along with the awareness of current national and international happenings. He/she should be aware of the types of questions being asked in GATE examination.

Course Outcome: -

1. This subject is taught to polish and enhance various aptitude skills and cognitive knowledge of the students and prepare them to be successful in the fields different competitive examinations like GATE,CAT, MAT,GMAT,UPSC, WBCS, Banking services, Indian Defence Services ,Combined
Graduate Level etc.
2. This way our students are trained not only for private sectors but also for public sectors to secure a fulfilling career.

Topic:
1. Questions from GATE to be solved by students. (6000 + questions).
2. NET equivalent examinations related questions to be solved from engineering domain.
3. CAT previous years question solved.
4. Banking Services questions solved.

Text Books: NONE

Mandatory Additional Requirements (MAR)
Code: MC881
Credit: 0

Innovative Project -VI / Entrepreneurship / Corporate Internship
Code:PROJ-CS801
Contact Hours: 6L
Credit: 6

Massive Open Online Courses (Mandatory for B.Tech (Honours))
Code: MOOC 8
Credit:5

Grand Viva-Voce
Code: PCC-CS881
Credit: 2