USHA MITTAL INSTITUTE OF TECHNOLOGY

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SNDT Women's University

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Syllabus B. Tech.
CST Syllabus

SNDT Women's University

1, Nathibai Thackersey Road,
Mumbai 400 020

(Applicable to students taking admission in and after 2019)

Credit Definition

1 Hr. Lecture (L) per week	1 credit
1 Hr. Tutorial (T) per week	1 credit
1 Hr. Practical (P) per week	0.5 credits
2 Hours Practical(Lab)/week	1 credit

Course code and Definition:

Course Code	Definitions
L	Lecture
T	Tutorial
P	Practical
D	Duration of Paper
TP	Term Paper
TW	Term Work
P/V	Practical/Viva
BSC	Basic Science Courses
ESC	Engineering Science Courses
HSMC	Humanities and Social Sciences including Management courses
PCC	Professional core courses
PEC	Professional Elective courses
OEC	Open Elective courses
LC	Laboratory course
MC	Mandatory courses
PROJ	Project

	USHA MITTAL INSTITUTE OF TECHNOLOGY **SNDT Women's University** **Faculty : Technology (Undergraduate Course) -BTech**	**Proposed in Jan 2020**

Semester I

Category and Course Code	**Course Title**	**Hours Per Week**			**Cr**	**D**	**TP**	**TW**	**P/V**	**Total**
		L	**T**	**P**						
Basic Science course (BSC101)	Applied Science (Physics and Chemistry)	3	1	-	4.0	2.5	75	25		100
Basic Science course (BSC103)	Mathematics –I	3	1	-	4.0	2.5	75	25		100
Engineering Science Courses(ESC101)	Basic Electrical Engineering	3	1	-	4.0	2.5	75	25		100
Engineering Science Courses(ESC102)	Engineering Graphics & Design	1	-	-	1.0	1.0	25	-		25
	Applied Science Lab			3	1.5	-	25	25	PV	50
	Basic Electrical Engineering Lab			2	1.0	-	25	-	PV	25
	Engineering Graphics & Design Lab	-	-	4	2.0	-	25	25	V	50
Mandatory Course	**Induction programme**	**3 weeks - no credits**								
	Total	**10**	**3**	**9**	**17.5**					**450**

Semester II

Category and Course Code	Course Title	Hours Per Week			Cr	D	TP	TW	P/V	Total
		L	T	P						
Basic Science courses (BSC 102)	Applied Science (Physics and Chemistry)	3	1	-	4.0	2.5	75	25		100
Basic Science course (BSC104)	Mathematics –II	3	1	-	4.0	2.5	75	25		100
Engineering Science Courses(ESC103)	Programming for Problem Solving	3	-	-	3.0	2.5	75	25		100
Engineering Science Courses(ESC104)	Workshop/Manufacturing Practices	1	-	-	1.0	1.0	25	-		25
Humanities and Social Sciences including Management courses (HSMC101)	English	2	-	-	2.0	1.0	40	10		50
	Applied Science Lab			3	1.5	-	25	25	PV	50
	Programming for Problem Solving Lab			4	2.0	-	25	25	PV	50
	Workshop/Manufacturing Practices Lab			4	2.0		25	25	PV	50
	English Practical			2	1.0	-	-	25	-	25
Mandatory Course	Environmental Sciences	2	-	-	0	2.0	50	-	-	50
	Total	**14**	**2**	**13**	**20.5**					**600**

***Environmental Sciences is a mandatory credit less course in which the students will be required to get passing marks in the main exam**

	USHA MITTAL INSTITUTE OF TECHNOLOGY **SNDT Women's University** **Faculty : Technology (Undergraduate Course) -BTech**	**Proposed in Jan 2020**

SCHEME: Semester III

Category and Code	**Course title**	**Hours per Week**			**Cr**	**D**	**TP**	**T W**	**P/V**	**Total**
		L	**T**	**P**						
Engineering Science Course ESC 301	Analog Electronic Circuits	3	0	-	3	2.5	75	25		100
Professional Core Courses PCC-CS 301	Data structure & Algorithms	3	0	-	3	2.5	75	25		100
Professional Core Courses ESC 302	Digital Electronics	3	0	-	3	2.5	75	25		100
Basic Science course BSC 301	Mathematics-III (Probability and Statistics)	2	0	0	2	1.5	50	0		50
	Analog Electronic Circuits Lab			4	2	-	25	25	PV	50
	Data structure & Algorithms Lab			4	2	-	25	25	PV	50
	Digital Electronics Lab			4	2	-	25	25	PV	50
	IT Workshop (Sci Lab/MATLAB) Lab			4	2	-	25	25	PV	50
	Total	11	0	16	19					575

SCHEME: Semester IV

Category and Code	**Course title**	**Hours per Week**			**C r**	**D**	**TP**	**TW**	**P/V**	**Total**
		L	**T**	**P**						
Professional Core Courses PCC- CS401	Discrete Mathematics	3	1	0	4	2.5	75	25		100
Engineering Science Course PCC-CS 402	Computer Organization & Architecture	3	0	-	3	2.5	75	25		100
Professional Core Courses PCC- CS403	Operating Systems	3	0	-	3	2.5	75	25		100

Professional Core Courses PCC- CS404	Design & Analysis of Algorithms	3	0	-	3	2.5	75	25		100
Humanities & Social Sciences including Management courses HSMC 401	Management 1 (Finance & Accounting)	3	0	0	3	2.5	75	25		100
Mandatory Courses MC	Constitution of India	-	-	-	0	-	25	25		50
	Computer Organization & Architecture Lab			4	2	-	25	25	PV	50
	Operating Systems Lab			4	2	-	25	25	PV	50
	Design & Analysis of Algorithms Lab			4	2	-	25	25	PV	50
	Total	15	1	12	22					700

NOTE: Subject "Constitution of India" is non credit subject, Passing is mandatory, A total of 16 hours needs to be completed.

Humanities Elective: $MOOC/ Swayam based course Certificate has to be provided by individual students to get evaluated.

Category	**Basic Science Course**				
Course title	**Applied Science - I (Physics & Chemistry)**				
Scheme and Credits	**L**	**T**	**P**	**Credit**	**Semester I**
	3	**1**	**-**	**4**	
Pre-requisites (if any)	**-**				
Course Objective	The concepts developed in this course will aid in quantification of several concepts in chemistry and physics that have been introduced at the 10+2 levels in schools. Technology is being increasingly based on the electronic, atomic and molecular level modifications. Quantum theory is more than 100 years old and to understand phenomena at nanometer levels, one has to base the description of all chemical processes at molecular levels. The course will enable the student to: • Learn the basics of electromagnetism. • Analyse microscopic chemistry in terms of atomic and molecular orbitals and energy level diagrams.				

	• Distinguish the ranges of the electromagnetic spectrum used for exciting different molecular energy levels in various spectroscopic techniques. • Understand the properties of the elements and classification of the elements in the periodic table based on their periodic properties.
Course Outcomes	• Learn about electric and magnetic fields. • Learn about scaler and vector fields. • Maxwell's equations that define basic laws of electromagnetism. • Propagation of electromagnetic waves through free space(Vacuum or Non conducting media). • Analyse atomic and molecular structure in terms of wavefunctions, charge densities and energy level diagrams. • Obtain quantitative information about energy levels through molecular spectroscopic methods such as electronic, vibrational, rotational and nuclear magnetic resonance (NMR) spectroscopy. • Rationalise periodic properties such as ionization potential, electronegativity, oxidation states and electronegativity

(I) Physics-I: Introduction to Electromagnetic Theory

Module 1:Electrostatics (5 Hours)
Electrostatics in vacuum ; Laplace's and Poisson's equations for electrostatic potential and uniqueness of their solution and connection with steady state diffusion and thermal conduction.
Electrostatics in a linear dielectric medium
Electrostatic field and potential of a dipole. Bound charges due to electric polarization; Electric displacement; boundary conditions on displacement**.**

Module 2: Magnetostatics (8 Hours)
Bio-Savart law, Divergence and curl of static magnetic field; vector potential and calculating it for a given magnetic field using Stokes' theorem; the equation for the vector potential and its solution for given current densities.
Magnetostatics in a linear magnetic medium
Magnetization and associated bound currents; auxiliary magnetic field ; Boundary conditions on and . Solving for magnetic field due to simple magnets like a bar magnet;magnetic susceptibility and ferromagnetic, paramagnetic and diamagnetic materials.

Module 3: Faraday's law (3 Hours)
Faraday's law in terms of EMF produced by changing magnetic flux; equivalence ofFaraday's law and motional EMF; Lenz's law; Electromagnetic breaking and itsapplications; Differential form of Faraday's law expressing curl of electric field in terms of time-derivative of magnetic field and calculating electric field due to changing magnetic fields in quasi-static approximation; energy stored in a magnetic field.

Module 4: Displacement current, Magnetic field due to time-dependent electric field and Maxwell's

equations (4 Hours)
Continuity equation for current densities; Modifying equation for the curl of magnetic field to satisfy continuity equation; displace current and magnetic field arising from timedependent electric field; calculating magnetic field due to changing electric fields in quasistatic approximation. Maxwell's equation in vacuum and non-conducting medium; Energyin an electromagnetic field; Flow of energy and Poynting vector with examples. Qualitative discussion of momentum in electromagnetic fields.

(II) Chemistry - I

Module 1: Introduction to quantum chemistry and atomic structure (4 Hours)
Schrodinger equation. Particle in a box solutions and their applications for conjugated molecules and nanoparticles. Forms of the hydrogen atom wave functions and the plots of these functions to explore their spatial variations..

Module 2: Molecular structure and energy level diagrams (6 Hours)
Molecular orbitals of diatomic molecules and plots of the multicenter orbitals. Equations for atomic and molecular orbitals. Energy level diagrams of diatomic molecules. Pi-molecular orbitals of butadiene and benzene and aromaticity. Crystal field theory and the energy level diagrams for transition metal ions and their magnetic properties. Band structure of solids and the role of doping on band structures

Module 3: Spectroscopic techniques and applications (6 Hours)
Principles of spectroscopy and selection rules. Electronic spectroscopy. Fluorescence and its applications in medicine. Vibrational and rotational spectroscopy of diatomic molecules. Applications. Nuclear magnetic resonance and magnetic resonance imaging, surface characterisation techniques, Diffraction and scattering.

Module 4: Periodic properties (4 Hours)
Effective nuclear charge, penetration of orbitals, variations of s, p, d and f orbital energies of atoms in the periodic table, electronic configurations, atomic and ionic sizes, ionization energies, electron affinity and electronegativity, polarizability, oxidation states, coordination numbers and geometries, hard soft acids and bases, molecular geometries.

Suggested Text / Reference Books:
(i) David Griffiths, Introduction to Electrodynamics
(ii) Halliday and Resnick, Physics
(iii) W. Saslow, Electricity, magnetism and light
(iv) University chemistry, by B. H. Mahan
(v) Chemistry: Principles and Applications, by M. J. Sienko and R. A. Plane
(vi)Fundamentals of Molecular Spectroscopy, by C. N. Banwell
(vii)Engineering Chemistry (NPTEL Web-book), by B. L. Tembe, Kamaluddin and M. S. Krishnan
(viii) Physical Chemistry, by P. W. Atkins

Category	**Basic Science Course**				
Course title	**Applied Science - I (Physics & Chemistry) Lab**				
Scheme and Credits	**L**	**T**	**P**	**Credit**	**Semester I**
	-	**-**	**3**	**1.5**	
Pre-requisites (if any)	**-**				
Course Objective					
Course Outcomes	The physics and chemistry laboratory course will consist of experiments illustrating the principles of physics and chemistry relevant to the study of science and engineering. The students will learn to: ● Analyze & generate experimental skills ● Learn and apply basic techniques used in chemistry laboratory for preparation, purification and identification. ● Employ the basic techniques used in chemistry laboratory for analyses such as chromatography, spectroscopy, volumetric titrations, conductometry. ● Learn safety rules in the practice of laboratory investigations.				

Choice of 10-12 experiments from the following:

1) Determination of surface tension and viscosity.
2) Ion exchange column for removal of hardness of water.
3) Determination of chloride content of water
4) Determination of the rate constant of a reaction
5) Determination of cell constant and conductance of solutions.
6) Preparation of a Coordination complex and it's chemical analysis.
7) Lattice structures and packing of spheres
8) Models of potential energy surfaces
9) Chemical oscillations- Iodine clock reaction
10) Verification of Beer- Lambert's law- UV-Visible spectroscopy.
11) Experiments on electromagnetic induction and electromagnetic breaking;
12) LC circuit and LCR circuit;
13) Resonance phenomena in LCR circuits;
14) Magnetic field from Helmholtz coil;
15) Measurement of Lorentz force in a vacuum tube

Category	**Engineering Science Course**				
Course title	**Mathematics-I**				
Scheme and Credits	**L**	**T**	**P**	**Credit**	**Semester I**
	3	**1**	**-**	**4**	
Pre-requisites (if any)	-				
Course Objective	• To introduce the idea of applying differential and integral calculus to notions of Curvature and to improper integrals. Apart from some applications it gives a basic introduction on Beta and Gamma functions. • To introduce the fallouts of Rolle's Theorem that is fundamental to application of analysis to Engineering problems. • To develop the tool of power series and Fourier series for learning advanced Engineering Mathematics. • To familiarize the student with functions of several variables that is essential in most branches of engineering. • To develop the essential tool of matrices and linear algebra in a comprehensive manner.				

Course Outcomes	The students will learn: • To apply differential calculus to notions of curvature and to improper integrals. Apart from some other applications they will have a basic understanding of Beta and Gamma functions. • The fallouts of Rolle's Theorem that is fundamental to application of analysis to Engineering problems. • The tool of power series and Fourier series for learning advanced Engineering Mathematics. • To deal with functions of several variables that are essential in most branches of Engineering. • The essential tool of matrices and linear algebra in a comprehensive manner.

Module 1: Calculus (12 hours)
Evolutes and involutes; Evaluation of definite and improper integrals; Beta and Gamma functions and their properties; Applications of definite integrals to evaluate surface areas and volumes of revolutions. Rolle's theorem, Mean value theorems, Taylor's and Maclaurin theorems with remainders; Indeterminate forms and L'Hospital's rule; Maxima and minima.

Module 2: Sequences and Series (10 hours)
Convergence of sequence and series, tests for convergence, power series, Taylor's series. Series for exponential, trigonometric and logarithmic functions; Fourier series: Half range sine and cosine series, Parseval's theorem.

Module 3: Multivariable Calculus: Differentiation (8 hours)
Limit, continuity and partial derivatives, directional derivatives, total derivative; Tangent plane and normal line; Maxima, minima and saddle points; Method of Lagrange multipliers; Gradient, curl and divergence.

Module 4: Matrices (10 lectures)
Inverse and rank of a matrix, rank-nullity theorem; System of linear equations; Symmetric, skew-symmetric and orthogonal matrices; Determinants; Eigenvalues and eigenvectors; Diagonalization of matrices; Cayley-Hamilton Theorem, and Orthogonal transformation.

Suggested Text/Reference Books

(i) G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition, Pearson, Reprint, 2002.
(ii) Erwin kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
(iii) Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008.
(iv) Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint, 2010.
(v) D. Poole, Linear Algebra: A Modern Introduction, 2nd Edition, Brooks/Cole, 2005.
(vi) N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2008.
(vii)B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010.

Category	**Engineering Science Course**				
Course title	**Basic Electrical Engineering Theory**				
Scheme and Credits	**L**	**T**	**P**	**Credit**	**Semester I**
	3	**1**	**-**	**4**	
Pre-requisites (if any)	-				
Course Objective	The students will be able to • Acquire knowledge about basic components of electrical circuits • Understand working of different electrical circuits • Analyze AC and DC circuits				
Course Outcomes	• To understand and analyze basic electric and magnetic circuits • To study the working principles of electrical machines • To introduce the components of low voltage electrical installations				

Module 1(DC Circuits) - (12 Hours)
Classification of devices of electrical circuits: Basic components of the circuit model a) Resistance b) Inductance c) Capacitance, Parameters and its representations (scope is definition ,sign conventions and graphical representations).

Basic circuit Analysis : Nodal analysis with voltage source, nodal analysis with current source, Mesh analysis using Matrix and Loop method a) Super mesh b) super node.
Network Theorems : Superposition, Thevenin's theorem, Norton's theorem, Reciprocity, Maximum power transfer theorem.

Module 2(AC Circuits) - (12 Hours)
Introduction to A.C. Circuits/Steady state analysis: Introduction & alternating currents and voltages a) sine wave, angular relation, phase of a sine wave, sine wave equation b) concepts of lead/lag c)voltage and current values of a sine wave, Instantaneous value, peak value, R.M.S. value, average value .form factor, phasor representation of 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), resonance.
Power in A.C. circuits: a) pure resistor, capacitor and inductor circuits b) Concepts of power factors, application of power factor, phase diagrams. V-I star delta

Module 3(Electrical Machine) - (10 Hours)
Transformers: Magnetic materials, BH characteristics, ideal and practical transformer, equivalent circuit, losses in transformers, regulation and efficiency. Auto-transformer and three-phase transformer connections.
Electrical Machines : Generation of rotating magnetic fields, Construction and working of Single-phase induction motor. Torque-speed characteristic and speed control of separately excited dc motor. Construction and working of synchronous generators.Single Phase Synchronous Machines and DC Machine

Module 4(Power Convertors and Electrical Installation) - (8 Hours)
Power Converters -DC-DC buck and boost converters, duty ratio control. Single-phase and three-phase voltage source inverters; sinusoidal modulation.
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.

Suggested Text / Reference 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.
6. B. L. Theraja, "Electrical Engg. &Technology",2nd Edition, S.Chand & Co, 2010.
7. Van Valkenberg, "Network analysis",3rd Edition, Prentice Hall of India, 2011.

Category	**Engineering Science Course**				
Course title	**Basic Electrical Engineering Lab**				
Scheme and Credits	**L**	**T**	**P**	**Credit**	**Semester I**
	-	**-**	**2**	**1**	
Pre-requisites (if any)	**-**				
Course Objective	The students will be able to ● Acquaintance of basic components of electrical circuits ● Practical knowledge of different electrical circuits and theorem ● Analyze AC and DC circuits				
Course Outcomes	● Get an exposure to common electrical components and their ratings. ● Make electrical connections by wires of appropriate ratings. ● Understand the usage of common electrical measuring instruments. ● Understand the basic characteristics of transformers and electrical machines. ● Get an exposure to the working of power electronic converters.				

List of Experiments To be conducted:

- Basic safety precautions. Introduction and use of measuring instruments–voltmeter, ammeter, multi-meter, oscilloscope. Real-life resistors, capacitors and inductors.

- Measuring the steady-state and transient time-response of R-L, R-C, and R-L-C circuits to a step change in voltage (transient may be observed on a storage oscilloscope). Sinusoidal steady state response of R-L, and R-C circuits – impedance calculation and verification. Observation of phase differences between current and voltage. Resonance in R-L-C circuits.
- Transformers: Observation of the no-load current waveform on an oscilloscope (non-sinusoidal wave-shape due to B-H curve nonlinearity should be shown along with a discussion about harmonics). Loading of a transformer: measurement of primary and secondary voltages and currents, and power. Three-phase transformers: Star and Delta connections. Voltage and Current relationships (line-line voltage, phase-to-neutral voltage, line and phase currents). Phase-shifts between the primary and secondary side. Cumulative three-phase power in balanced three-phase circuits.
- Demonstration of cut-out sections of machines: dc machine (commutator-brush arrangement), induction machine (squirrel cage rotor), synchronous machine (field winging - slip ring arrangement) and single-phase induction machine.
- Torque Speed Characteristic of separately excited dc motor.
- Synchronous speed of two and four-pole, three-phase induction motors. Direction reversal by change of phase-sequence of connections. Torque-Slip Characteristic of an induction motor. Generator operation of an induction machine driven at super-synchronous speed.
- Synchronous Machine operating as a generator: stand-alone operation with a load. Control of voltage through field excitation.
- Demonstration of (a) dc-dc converters (b) dc-ac converters – PWM waveform (c) the use of dc-ac converter for speed control of an induction motor and (d) Components of LT switchgear.

Category	**Engineering Science Course**				
Course title	**Engineering Graphics & Design**				
Scheme and Credits	**L**	**T**	**P**	**Credit**	**Semester I**
	1	**0**	**-**	**1**	
Pre-requisites (if any)	-				
Course Objective	• Introduction to engineering design and its place in society • Exposure to the visual aspects of engineering design • Exposure to engineering graphics standards • Exposure to solid modelling				
Course Outcomes	• to prepare you 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 • to prepare you to communicate effectively • to prepare you to use the techniques, skills, and modern engineering tools necessary for engineering practice				

Detailed contents

Traditional Engineering Graphics:
Principles of Engineering Graphics; Orthographic Projection; Descriptive Geometry;

Drawing Principles; Isometric Projection; Surface Development; Perspective; Reading a Drawing; Sectional Views; Dimensioning & Tolerances; True Length, Angle; intersection, Shortest Distance.

Computer Graphics:

Engineering Graphics Software; -Spatial Transformations; Orthographic Projections; Model Viewing; Coordinate Systems; Multi-view Projection; Exploded Assembly; Model Viewing; Animation; Spatial Manipulation; Surface Modelling; Solid Modelling; Introduction to Building Information Modelling (BIM)

Suggested Text/Reference Books:

(i) Bhatt N.D., Panchal V.M. & Ingle P.R., (2014), Engineering Drawing, Charotar Publishing House
(ii) Shah, M.B. & Rana B.C. (2008), Engineering Drawing and Computer Graphics, Pearson Education
(iii)Agrawal B. & Agrawal C. M. (2012), Engineering Graphics, TMH Publication
(iv) Narayana, K.L. & P Kannaiah (2008), Text book on Engineering Drawing, Scitech Publishers
(v) (Corresponding set of) CAD Software Theory and User Manuals

Category	**Engineering Science Course**				
Course title	**Engineering Graphics & Design Lab**				
Scheme and Credits	**L**	**T**	**P**	**Credit**	**Semester I**
	-	**-**	**4**	**2**	
Pre-requisites (if any)	**-**				
Course Objective	• All phases of manufacturing or construction require the conversion of new ideas and design concepts into the basic line language of graphics. Therefore, there are many areas (civil, mechanical, electrical, architectural and industrial) in which the skills of the CAD technicians play • major roles in the design and development of new products or construction.				
Course Outcomes	• Students prepare for actual work situations through practical training in a new state-of-the-art computer designed CAD laboratory using engineering software				

Module 1: Introduction to Engineering Drawing covering, Principles of Engineering Graphics and their significance, usage of Drawing instruments, lettering, Conic sections including the Rectangular Hyperbola (General method only); Cycloid, Epicycloid, Hypocycloid and Involute; Scales – Plain, Diagonal and Vernier Scales;

Module 2: Orthographic Projections covering, 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 covering, those inclined to both the Planes- Auxiliary Views; Draw simple annotation, dimensioning and scale. Floor plans that include: windows, doors, and fixtures such as WC, bath, sink, shower, etc.

Module 4:Sections and Sectional Views of Right Angular Solids covering, 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, objects from industry and dwellings (foundation to slab only)

Module 5: Isometric Projections **covering,**

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 covering

listing 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.; Isometric Views of lines, Planes, Simple and compound Solids];

Module 7: Customisation & CAD Drawing

consisting of 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 covering 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; Drawing annotation, Computer-aided design (CAD) software modeling of parts and assemblies. Parametric and non-parametric solid, surface, and wireframe models. Part editing and two-dimensional documentation of models. Planar projection theory, including sketching of perspective, isometric, multiview, auxiliary, and section views. Spatial visualization exercises. Dimensioning guidelines, tolerancing techniques; dimensioning and scale multi views of dwelling;

Module 9: Demonstration of a simple team design project *that illustrates*

Geometry and topology of engineered components: creation of engineering models and their presentation in standard 2D blueprint form and as 3D wire-frame and shaded solids; meshed topologies for engineering analysis and tool-path generation for component manufacture; geometric dimensioning and tolerancing; Use of solid-modeling software for creating associative models at the component and assembly levels; floor plans that include: windows, doors, and fixtures such as WC, bath, sink, shower, etc. Applying colour coding according to building drawing practice; Drawing sectional elevation showing foundation to ceiling; Introduction to Building Information Modelling (BIM).

Category	**Basic Science Course**				
Course title	**Applied Science - II (Physics & Chemistry)**				
Scheme and Credits	**L**	**T**	**P**	**Credit**	**Semester II**
	3	**1**	**-**	**4**	
Pre-requisites (if any)	**-**				
Course Objective	The concepts developed in this course will aid in quantification of several concepts in physics and chemistry that have been introduced at the 10+2 levels in schools. Technology is being increasingly based on the electronic, atomic and molecular level modifications and to understand phenomena at nanometer levels, one has to base the description of all chemical processes at molecular levels. The course will enable the student to: scillations, waves and optics. he thermodynamic concepts such as entropy, free energy, cell potentials and apply those to ystems. d the molecular forces existing in a bulk, macroscopic system. he Stereochemistry and operations in a 3 dimensional molecule, configurations possible in e. emical reactions involved in the synthesis of molecules and also able to synthesize drug .				
Course Outcomes	• Imparted knowledge about simple harmonic oscillations, mechanical and electric oscillators.				

	• Learn about different kinds of damping in harmonic oscillators. • Learn about non dispersive transverse and longitudinal waves in one dimension,acoustic waves and sound waves. • Know about interference and diffraction phenomena. They will also learn about Michelson Interferrometer (also learn why the result was negative. Learn about why they found no significant difference between the speed of light in the direction of movement through the presumed aether, and the speed at right angles. • Understand how Young's double slit experiment and diffraction grating work. • Interaction of radiation with matter, Einstein coefficients , working of different types of Lasers and their application in science, engineering and medicine. • Rationalise bulk properties and processes using thermodynamic considerations. • Understand the energies existing in a bulk macroscopic system. • List major chemical reactions that are used in the synthesis of molecules. • Rationalize the terms and concepts involved in Stereochemistry like symmetry operations, chirality, isomerism etc.

(I) Physics- II: Oscillations, waves and optics

Module 1: Electromagnetic waves (7 hours)
The wave equation; Plane electromagnetic waves in vacuum, their transverse nature and polarization; relation between electric and magnetic fields of an electromagnetic wave; energy carried by electromagnetic waves and examples. Momentum carried by electromagnetic waves and resultant pressure. Reflection and transmission of electromagnetic waves from a non-conducting medium-vacuum interface for normal incidence.

Module 2: Wave optics (5 hours)
Huygens' principle, superposition of waves and interference of light by wave front splitting and amplitude splitting; Young's double slit experiment, Newton's rings, Michelson interferometer. Farunhofer diffraction from a single slit and a circular aperture, the Rayleigh criterion for limit of resolution and its application to vision; Diffraction gratings and their resolving power.

Module 3: Lasers (2 hours)
Einstein's theory of matter radiation interaction and A and B coefficients; amplification of light by population inversion,

Module 4: Different types of lasers (6 hours):
gas lasers (He-Ne, CO2), solid-state lasers(ruby, Neodymium), dye lasers; Properties of laser beams: mono-chromaticity, coherence, directionality and brightness, laser speckles, applications of lasers in science, engineering and medicine.

(II) Chemistry-II

Module 1: Intermolecular forces and potential energy surfaces (4 hours)
Ionic, dipolar and van Der Waals interactions. Equations of state of real gases and critical phenomena. Potential energy surfaces of H3, H2F and HCN and trajectories on these surfaces.

Module 2: Use of free energy in chemical equilibria (6 hours)
Thermodynamic functions: energy, entropy and free energy. Estimations of entropy and free energies. Free energy and emf. Cell potentials, the Nernst equation and applications. Acid base, oxidation reduction and solubility equilibria. Water chemistry. Corrosion. Use of free energy considerations in metallurgy through Ellingham diagrams.

Module 3: Stereochemistry (6 hours)
Representations of 3 dimensional structures, structural isomers and stereoisomers, configurations and symmetry and chirality, enantiomers, diastereomers, optical activity, absolute configurations and conformational analysis. Isomerism in transition metal compounds.

Module 4: Organic reactions and synthesis of organic drug molecule (4 hours)
Introduction to reactions involving substitution, addition, elimination, oxidation, reduction, cyclization and ring openings. Synthesis of a commonly used drug molecule.

Suggested Text / Reference Books:

(i) Ian G. Main, Oscillations and waves in physics
(ii) H.J. Pain, The physics of vibrations and waves
(iii) E. Hecht, Optics
(iv) A. Ghatak, Optics
(v) O. Svelto, Principles of Lasers
(vi) University chemistry, by B. H. Mahan
(vii) Chemistry: Principles and Applications, by M. J. Sienko and R. A. Plane
(viii) Fundamentals of Molecular Spectroscopy, by C. N. Banwell
(ix) Engineering Chemistry (NPTEL Web-book), by B. L. Tembe, Kamaluddin and M. S. Krishnan
(x) Physical Chemistry, by P. W. Atkins
(xi) Organic Chemistry: Structure and Function by K. P. C. Volhardt and N. E. Schore, 5th Edition
http://bcs.whfreeman.com/vollhardtschore5e/default.asp

Category	**Basic Science Course**				
Course title	**Applied Science - II (Physics & Chemistry) Lab**				
Scheme and Credits	**L**	**T**	**P**	**Credit**	**Semester II**
	-	**-**	**3**	**1.5**	
Pre-requisites (if any)	**-**				
Course Objective					
Course Outcomes	The students will learn to: • Estimate rate constants of reactions from concentration of reactants/products as a function of time • Measure molecular/system properties such as surface tension, viscosity, conductance of solutions, redox potentials, chloride content of water, etc • Synthesize a small drug molecule and analyse a salt sample				

Choice of 9-10 experiments from the following:
1) Colligative properties using freezing point depression.
2) Determination of the rate constant of a reaction.
3) Determination of cell constant and conductance of solutions.
4) Potentiometry - determination of redox potentials and emfs
5) Synthesis of a polymer/drug

6) Saponification/acid value of an oil
7) Determination of the partition coefficient of a substance between two immiscible liquids.
8) Adsorption of acetic acid by charcoal
9) Use of the capillary viscometers to the demonstrate of the isoelectric point as the pH of minimum viscosity for gelatin sols and/or coagulation of the white part of egg.
10) Determine the wavelength of unknown line using plane transmission grating
11) Determine the resolving power grating using sodium light.
12) Dispersive power of the prism
13) To observe the Newton Rings produced by interference
14) Minimum deviation from a prism.

Category	**Engineering Science Course**				
Course title	**Mathematics-II**				
Scheme and Credits	**L**	**T**	**P**	**Credit**	**Semester II**
	3	**1**	**-**	**4**	
Pre-requisites (if any)	-				
Course Objective	• To acquaint the student with mathematical tools needed in evaluating multiple integrals and their usage. • To introduce effective mathematical tools for the solutions of differential equations that model physical processes. • To introduce the tools of differentiation and integration of functions of complex variable that are used in various techniques dealing engineering problems.				
Course Outcomes	• The mathematical tools needed in evaluating multiple integrals and their usage. • The effective mathematical tools for the solutions of differential equations that model physical processes. • The tools of differentiation and integration of functions of a complex variable that are used in various techniques dealing engineering problems.				

Module 1:Multivariable Calculus (Integration): (10 hours)
Multiple Integration: Double integrals (Cartesian), change of order of integration in double integrals, Change of variables (Cartesian to polar), Applications: areas and volumes, Center of mass and Gravity (constant and

variable densities);Triple integrals (Cartesian), orthogonal curvilinear coordinates, Simple applications involving cubes, sphere and rectangular parallelepipeds; Scalar line integrals, vector line integrals, scalar surface integrals, vector surface integrals, Theorems of Green, Gauss and Stokes.

Module 2:First order ordinary differential equations:(6 hours)
Exact, linear and Bernoulli's equations, Euler's equations, Equations not of first degree: equations solvable for p, equations solvable for y, equations solvable for x and Clairaut's type.

Module 3:Ordinary differential equations of higher orders:(8 hours)
Second order linear differential equations with variable coefficients, method of variation of parameters, Cauchy-Euler equation; Power series solutions; Legendre polynomials, Bessel functions of the first kind and their properties.

Module 4: Complex Variable – Differentiation and Integration(16 hours):
Differentiation, Cauchy-Riemann equations, analytic functions, harmonic functions, finding harmonic conjugate; elementary analytic functions (exponential, trigonometric, logarithm) and their properties; Conformal mappings, Mobius transformations and their properties.
Contour integrals, Cauchy-Goursat theorem (without proof), Cauchy Integral formula (without proof), Liouville's theorem and Maximum-Modulus theorem (without proof); Taylor's series, zeros of analytic functions, singularities, Laurent's series; Residues, Cauchy Residue theorem (without proof), Evaluation of definite integral involving sine and cosine, Evaluation of certain improper integrals using the Bromwich contour.

Textbooks/References:

1. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition, Pearson, Reprint, 2002.
2. Erwin kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
3. W. E. Boyce and R. C. DiPrima, Elementary Differential Equations and Boundary Value Problems, 9th Edn., Wiley India, 2009.
4. S. L. Ross, Differential Equations, 3rd Ed., Wiley India, 1984.
5. E. A. Coddington, An Introduction to Ordinary Differential Equations, Prentice Hall India, 1995.
6. E. L. Ince, Ordinary Differential Equations, Dover Publications, 1958.

Category	**Engineering Science Course**				
Course title	**Programming for Problem Solving Theory**				
Scheme and Credits	**L**	**T**	**P**	**Credit**	**Semester II**
	3	**-**	**-**	**3**	
Pre-requisites (if any)	**-**				
Course Objective					
Course Outcomes	• To formulate simple algorithms for arithmetic and logical problems. • To translate the algorithms to programs (in C language). • To test and execute the programs and correct syntax and logical errors. • To implement conditional branching, iteration and recursion. • To decompose a problem into functions and synthesize a complete program using divide and conquer approach. • To use arrays, pointers and structures to formulate algorithms and programs. • To apply programming to solve matrix addition and multiplication problems and searching and sorting problems. • To apply programming to solve simple numerical method problems, namely rot finding of function, differentiation of function and simple integration.				

Module 1 Introduction to Programming (4 Hours)

Introduction to components of a computer system (disks, memory, processor, where a program is stored and executed, operating system, compilers etc.) - (1 lecture). Idea of Algorithm: steps to solve logical and numerical problems. Representation of Algorithm: Flowchart/Pseudocode with examples. (1 lecture) From algorithms to programs; source code, variables (with data types) variables and memory locations, Syntax and Logical Errors in compilation, object and executable code- (2 lectures)

Module 2: **Arithmetic expressions and precedence (2 Hours)**
Conditional Branching and Loops (6 lectures) Writing and evaluation of conditionals and consequent branching (3 lectures) Iteration and loops (3 lectures)

Module 3 Arrays (6 Hours)
Arrays (1-D, 2-D), Character arrays and Strings

Module 4 Basic Algorithms (6 Hours)
Searching, Basic Sorting Algorithms (Bubble, Insertion and Selection), Finding roots of equations, notion of order of complexity through example programs (no formal definition required)

Module 5 Function (5 Hours)
Functions (including using built in libraries), Parameter passing in functions, call by value, Passing arrays to functions: idea of call by reference

Module 6 Recursion (4 -5 Hours)
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 7 Structure (4 Hours)
Structures, Defining structures and Array of Structures

Module 8 Pointers (2 Hours)
Idea of pointers, Defining pointers, Use of Pointers in self-referential structures, notion of linked list (no implementation)

Module 9 File handling (only if time is available, otherwise should be done as part of the lab)

Suggested Text Books/Suggested Reference Books

(i) Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill
(ii) E. Balaguruswamy, Programming in ANSI C, Tata McGraw-Hill
(i) Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice Hall of India

Category	**Basic Science Course**				
Course title	**Programming for Problem Solving Lab**				
Scheme and Credits	**L**	**T**	**P**	**Credit**	**Semester II**
	-	**-**	**4**	**2**	
Pre-requisites (if any)	**-**				
Course Objective					
Course Outcomes	• **To formulate the algorithms for simple problems** • **To translate given algorithms to a working and correct program** • **To be able to correct syntax errors as reported by the compilers** • **To be able to identify and correct logical errors encountered at run time** • **To be able to write iterative as well as recursive programs** • **To be able to represent data in arrays, strings and structures and manipulate them** • **through a program** • **To be able to declare pointers of different types and use them in defining self** • **referential structures.** • **To be able to create, read and write to and from simple text files.**				

[The laboratory should be preceded or followed by a tutorial to explain the

approach or algorithm to be implemented for the problem given.]

Tutorial 1: Problem solving using computers:
Lab1: Familiarization with programming environment
Tutorial 2: Variable types and type conversions:
Lab 2: Simple computational problems using arithmetic expressions
Tutorial 3: Branching and logical expressions:
Lab 3: Problems involving if-then-else structures
Tutorial 4: Loops, while and for loops:
Lab 4: Iterative problems e.g., sum of series
Tutorial 5: 1D Arrays: searching, sorting:
Lab 5: 1D Array manipulation
Tutorial 6: 2D arrays and Strings
Lab 6: Matrix problems, String operations
Tutorial 7: Functions, call by value:
Lab 7: Simple functions
Tutorial 8 &9: Numerical methods (Root finding, numerical differentiation, numerical integration):
Lab 8 and 9: Programming for solving Numerical methods problems
Tutorial 10: Recursion, structure of recursive calls
Lab 10: Recursive functions
Tutorial 11: Pointers, structures and dynamic memory allocation
Lab 11: Pointers and structures
Tutorial 12: File handling:
Lab 12: File operations

Category	**Engineering Science Course**				
Course title	**Workshop/Manufacturing Practices Theory**				
Scheme and Credits	**L**	**T**	**P**	**Credit**	**Semester II**
	1	**-**	**-**	**1**	
Pre-requisites (if any)	**-**				
Course Objective	• Introduction to different manufacturing methods in different fields of engineering • Practical exposure to different fabrication techniques • Creation of simple components using different materials • Exposure to some of the advanced and latest manufacturing techniques being employed in the industry				
Course Outcomes	• Upon completion of this course, the students will gain knowledge of the different manufacturing processes which are commonly employed in the industry, to fabricate components using different materials.				

1. Manufacturing Methods- casting, forming, machining, joining, advanced manufacturing

methods **(3 Hours)**
2. CNC machining, Additive manufacturing **(1 Hours)**
3. Fitting operations & power tools **(1 Hours)**
4. Electrical & Electronics **(1 Hours)**
5. Carpentry **(1 Hours)**
6. Plastic moulding, glass cutting **(1 Hours)**
7. Metal casting **(1 Hours)**
8. Welding (arc welding & gas welding), brazing **(1 Hours)**

Suggested Text/Reference Books:

(i) 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.
(ii) Kalpakjian S. And Steven S. Schmid, "Manufacturing Engineering and Technology", 4th edition, Pearson Education India Edition, 2002.
(iii) Gowri P. Hariharan and A. Suresh Babu,"Manufacturing Technology – I" Pearson Education, 2008.
(iv) Roy A. Lindberg, "Processes and Materials of Manufacture", 4th edition, Prentice Hall India, 1998.
(v) Rao P.N., "Manufacturing Technology", Vol. I and Vol. II, Tata McGrawHill House, 2017.

Category	**Engineering Science Course**				
Course title	**Workshop/Manufacturing Practices Lab**				
Scheme and Credits	**L**	**T**	**P**	**Credit**	**Semester II**
	-	**-**	**4**	**2**	
Pre-requisites (if any)	-				
Course Objective	• Introduction to different manufacturing methods in different fields of engineering • Practical exposure to different fabrication techniques • Creation of simple components using different materials • Exposure to some of the advanced and latest manufacturing techniques being employed in the industry				
Course Outcomes	• Upon completion of this laboratory course, students will be able to fabricate components with their own hands. • They will also get practical knowledge of the dimensional accuracies and dimensional tolerances possible with different manufacturing processes. • By assembling different components, they will be able to produce small devices of their interest.				

1. Machine shop **(10 hours)**
2. Fitting shop **(8 hours)**
3. Carpentry **(6 hours)**
4. Electrical & Electronics **(8 hours)**
5. Welding shop **[8 hours (Arc welding 4 hrs + gas welding 4 hrs)]**

6. Casting **(8 hours)** 7. Smithy **(6 hours)** 8. Plastic moulding & Glass Cutting **(6 hours)**

Category	**Humanities and Social Sciences including Management courses**				
Course title	**English**				
Scheme and Credits	**L**	**T**	**P**	**Credit**	**Semester II**
	2	**-**	**-**	**2**	
Pre-requisites (if any)	-				
Course Objective	• Construct grammatically correct sentences • Design effective letters • Write effective essays • Make formal presentations				
Course Outcomes	• The learners will be able to acquire basic proficiency in English including reading, writing, listening and speaking skills				

Module 1 - Writing Skills

(10 Hours)

Basic Writing Skills

1. Sentence Structures
2. Use of phrases and clauses in sentences
3. Importance of proper punctuation
4. Creating coherence
5. Organizing principles of paragraphs in documents
6. Techniques for writing precisely

Nature and Style of sensible Writing

1. Describing
2. Defining

3. Classifying
4. Providing examples or evidence
5. Writing introduction and conclusion

Module 2 - Grammar and Vocabulary (10 Hours)

Vocabulary Building

1. The concept of Word Formation
2. Root words from foreign languages and their use in English
3. Acquaintance with prefixes and suffixes from foreign languages in English to form derivatives.

1. Synonyms, antonyms, and standard abbreviations.

Identifying Common Errors in Writing

1. Subject-verb agreement
2. Noun-pronoun agreement
3. Misplaced modifiers
4. Articles
5. Prepositions
6. Redundancies
7. Clichés

Module 3 - Writing and Oral Skills (10 Hours)

Writing Practices

1. Comprehension
2. Précis Writing
3. Essay Writing

Oral Communication

(This unit involves interactive practice sessions in Language Lab)

1. Listening Comprehension
2. Pronunciation, Intonation, Stress and Rhythm
3. Common Everyday Situations: Conversations and Dialogues
4. Communication at Workplace
5. Interviews
6. Formal Presentations

Suggested Text/Reference Books:

1. Practical English Usage. Michael Swan, OUP.1995
2. Remedial English Grammar. F. T. Wood. Macmillan. 2007
3. On Writing Well. William Zinsser. Harper Resource Book. 2001
4. Study Writing. Liz Hamp-Lyons and Ben Heasley. Cambridge University Press. 2006
5. Communication Skills. Sanjay Kumar and Pushpatalata. Oxford University press. 2011
6. Exercise in Spoken English. Parts I-III, CIEFL, Hyderabad. Oxford University press

Category	**Humanities and Social Sciences including Management courses**				
Course title	**English Lab**				
Scheme and Credits	**L**	**T**	**P**	**Credit**	**Semester I**
	-	**-**	**2**	**1**	
Pre-requisites (if any)	-				
Course Objective					
Course Outcomes	The student will acquire basic proficiency in English including reading and listening comprehension, writing and speaking skills.				

Oral Communication

(This unit involves interactive practice sessions in Language Lab)

1. Listening Comprehension
2. Pronunciation, Intonation, Stress and Rhythm
3. Common Everyday Situations: Conversations and Dialogues
4. Communication at Workplace
5. Interviews
6. Formal Presentations

Category	**Engineering Science Course**				
Course title	**Analog Electronic Circuits**				
Scheme and Credits	**L**	**T**	**P**	**Credit**	**Semester III**
	3	-	-	**3**	
Pre-requisites (if any)	-				
Course Objective					
Course Outcomes	At the end of this course, students will demonstrate the ability to 1. Understand the characteristics of transistors 2. Design and analyse various rectifier and amplifier circuits. 3. Design sinusoidal and non-sinusoidal oscillators. 4. Understand the functioning of OP-AMP and design OP-AMP based circuits.				

Module 1: Diode circuits (4 Hours)

P-N junction diode, I-V characteristics of a diode; review of half-wave and full-wave rectifiers, Zener diodes, clamping and clipping circuits.

Module 2: BJT circuits (8 Hours)

Structure and I-V characteristics of a BJT; BJT as a switch. BJT as an amplifier: small-signal model, biasing circuits, current mirror; common-emitter, common-base and common collector amplifiers; Small signal equivalent circuits, high-frequency equivalent circuits

Module 3: MOSFET circuits (8 Hours)

MOSFET structure and I-V characteristics. MOSFET as a switch. MOSFET as an amplifier: small-signal model and biasing circuits, common-source, common-gate and common-drain amplifiers; small signal equivalent circuits - gain, input and output impedances, transconductance, high frequency equivalent circuit.

Module 4: Differential, multi-stage and operational amplifiers (8 Hours)

Differential amplifier; power amplifier; direct coupled multi-stage amplifier; internal structure of an operational amplifier, ideal op-amp, non-idealities in an op-amp (Output offset voltage, input bias current, input offset current, slew rate, gain bandwidth product)

Module 5: Linear applications of op-amp (8 Hours)

Idealized analysis of op-amp circuits. Inverting and non-inverting amplifier, differential amplifier, instrumentation amplifier, integrator, active filter, P, PI and PID controllers and lead/lag compensator using an op-amp, voltage regulator, oscillators (Wein bridge and phase shift).
Analog to Digital Conversion.

Module 6: Nonlinear applications of op-amp (6 Hours)

Hysteretic Comparator, Zero Crossing Detector, Square-wave and triangular-wave generators. Precision rectifier, peak detector. Monoshot.

Text/References:

1. A. S. Sedra and K. C. Smith, "Microelectronic Circuits", New York, Oxford University Press, 1998.
2. J. V. Wait, L. P. Huelsman and G. A. Korn, "Introduction to Operational Amplifier theory and applications", McGraw Hill U. S., 1992.
3. J. Millman and A. Grabel, "Microelectronics", McGraw Hill Education, 1988. ICTE Model Curriculum for Undergraduate degree in Electrical Engineering (Engineering & Technology) 212 | Page
4. P. Horowitz and W. Hill, "The Art of Electronics", Cambridge University Press, 1989.
5. P. R. Gray, R. G. Meyer and S. Lewis, "Analysis and Design of Analog Integrated Circuits", John Wiley & Sons, 2001.

Category	**Professional Core Courses**				
Course title	**Data structure &Algorithms**				
Scheme and Credits	**L**	**T**	**P**	**Credit**	**Semester III**
	3	-	-	**3**	
Pre-requisites (if any)	-				
Course Objective	1. To impart the basic concepts of data structures and algorithms. 2. To understand concepts about searching and sorting techniques 3. To understand basic concepts about stacks, queues, lists, trees and graphs. 4. To enable them to write algorithms for solving problems with the help of fundamental data structures				
Course Outcomes	1. For a given algorithm student will able to analyze the algorithms to determine the time and computation complexity and justify the correctness. 2. For a given Search problem (Linear Search and Binary Search) student will able to implement it. 3. For a given problem of Stacks, Queues and linked list student will able to implement it and analyze the same to determine the time and computation complexity. 4. Student will able to write an algorithm Selection Sort, Bubble Sort, Insertion Sort, Quick Sort, Merge Sort, Heap Sort and compare their performance in term of Space and Time complexity. 5. Student will able to implement Graph search and traversal algorithms and determine the time and computation complexity.				

Module 1:
Introduction: Basic Terminologies: Elementary Data Organizations, Data Structure Operations: insertion, deletion, traversal etc.; Analysis of an Algorithm, Asymptotic Notations, Time-Space trade off. Searching: Linear Search and Binary Search Techniques and their complexity analysis.

Module 2:
Stacks and Queues: ADT Stack and its operations: Algorithms and their complexity analysis, Applications of Stacks: Expression Conversion and evaluation – corresponding algorithms and complexity analysis. ADT queue, Types of Queue: Simple Queue, Circular Queue, Priority Queue; Operations on each types of Queues: Algorithms and their analysis.

Module 3:
Linked Lists: Singly linked lists: Representation in memory, Algorithms of several operations: Traversing, Searching, Insertion into, Deletion from linked list; Linked representation of Stack and Queue, Header nodes, Doubly linked list: operations on it and algorithmic analysis; Circular Linked Lists: all operations their algorithms and the complexity analysis.
Trees: Basic Tree Terminologies, Different types of Trees: Binary Tree, Threaded Binary Tree, Binary Search Tree, AVL Tree; Tree operations on each of the trees and their algorithms with complexity analysis. Applications of Binary Trees. B Tree, B+ Tree: definitions, algorithms and analysis.

Module 4:
Sorting and Hashing: Objective and properties of different sorting algorithms: Selection Sort, Bubble Sort, Insertion Sort, Quick Sort, Merge Sort, Heap Sort; Performance and Comparison among all the methods, Hashing.
Graph: Basic Terminologies and Representations, Graph search and traversal algorithms and complexity analysis.

Suggested books:

1. "Fundamentals of Data Structures", Illustrated Edition by Ellis Horowitz, Sartaj Sahni, Computer Science Press.

Suggested reference books:

Algorithms, Data Structures, and Problem Solving with C++", Illustrated Edition by Mark Allen Weiss, Addison-Wesley Publishing Company

"How to Solve it by Computer" , 2nd Impression by R. G. Dromey, Pearson Education

Category	**Professional Core Courses**				
Course title	**Digital Electronics**				
Scheme and Credits	**L**	**T**	**P**	**Credit**	**Semester III**
	3	-	-	**3**	
Pre-requisites (if any)	-				
Course Objective					
Course Outcomes	At the end of this course, students will demonstrate the ability to 1. Understand working of logic families and logic gates. 2. Design and implement Combinational and Sequential logic circuits. 3. Understand the process of Analog to Digital conversion and Digital to Analog conversion. 4. Be able to use PLDs to implement the given logical problem.				

Module 1:Fundamentals of Digital Systems and logic families (7Hours)

Digital signals, digital circuits, AND, OR, NOT, NAND, NOR and Exclusive-OR operations, Boolean algebra, examples of IC gates, number systems-binary, signed binary, octal hexadecimal number, binary arithmetic, one's and two's complements arithmetic, codes, error detecting and correcting codes,characteristics of digital lCs, digital logic families, TTL, Schottky TTL and CMOS logic, interfacing CMOS and TTL, Tri-statelogic.

Module 2: Combinational Digital Circuits (7 Hours)

Standard representation for logic functions, K-map representation, simplification of logic functions using K-map, minimization of logical functions. Don't care conditions, Multiplexer, De-Multiplexer/Decoders, Adders, Subtractors, BCD arithmetic, carry look ahead adder, serial adder,

ALU, elementary ALU design, popular MSI chips, digital comparator, parity checker/generator, code converters, priority encoders, decoders/drivers for display devices, Q-M method of function realization.

Module 3: Sequential circuits and systems (7 Hours)

A 1-bit memory, the circuit properties of Bistable latch, the clocked SR flip flop, J- K-T and D- types flipflops, applications of flipflops, shift registers, applications of shift registers, serial to parallel converter, parallel to serial converter, ring counter, sequence generator, ripple(Asynchronous) counters, synchronous counters, counters design using flip flops, special counter IC's, asynchronous sequential counters, applications of counters.

Module 4: A/D and D/A Converters (7 Hours)

Digital to analog converters: weighted resistor/converter, R-2R Ladder D/A converter, specifications for D/A converters, examples of D/A converter lCs, sample and hold circuit, analog to digital converters: quantization and encoding, parallel comparator A/D converter, successive approximation A/D converter, counting A/D converter, dual slope A/D converter, A/D converter using voltage to frequency and voltage to time conversion, specifications of A/D converters, example of A/D converter ICs

Module 5: Semiconductor memories and Programmable logic devices (7Hours)

Memory organization and operation, expanding memory size, classification and characteristics of memories, sequential memory , read only memory(ROM), read and write memory(RAM), content addressable memory (CAM), charge de coupled device memory (CCD), commonly used memory chips, ROM as a PLD, Programmable logic array, Programmable array logic, complex Programmable logic devices (CPLDS), Field Programmable Gate Array (FPGA).

Text/References:

1. R. P. Jain, "Modern Digital Electronics", McGraw Hill Education, 2009.
2. M. M. Mano, "Digital logic and Computer design", Pearson Education India, 2016.
3. A. Kumar, "Fundamentals of Digital Circuits", Prentice Hall India, 2016.

Category	**Basic Science course BSC**				
Course title	**Mathematics-III ((Probability and Statistics)**				
Scheme and Credits	**L**	**T**	**P**	**Credit**	**Semester III**
	2	-	-	2	
Pre-requisites (if any)	-				
Course Objective	The objective of this course is to familiarize the students with statistical techniques. It aims to equip the students with standard concepts and tools at an intermediate to advanced level that will serve them well towards tackling various problems in the discipline.				
Course Outcomes	The students will learn: 1. The ideas of probability and random variables and various discrete and continuous probability distributions and their properties. 2. The basic ideas of statistics including measures of central tendency, correlation and regression. 3. The statistical methods of studying data samples.				

Module 1: Basic Probability: *(8 lectures)*

Probability spaces, conditional probability, independence; Bayes' rule, Discrete random variables, Independent random variables, sums of independent random variables; Continuous random variables and their properties, distribution functions and densities, Expectation of Discrete Random Variables and Continuous random variables, Variance of a sum, Correlation coefficient.

Module 2: Probability Distributions and Bivariate Distributions: *(10 lectures)*

Probability distributions: Binomial, Poisson and infinite sequences of Bernoulli trials, the multinomial distribution, Poisson approximation to the binomial distribution, Normal, Exponential and Gamma distributions. Moments of distributions. Bivariate distributions and their properties, distribution of sums and quotients, conditional densities.

Module 3: Basic Statistics: (6 lectures)

Measures of Central tendency: Moments, skewness and Kurtosis, Correlation and Regression – Rank correlation, correlation coefficient, Method of least squares, Coefficient of Regression

Module 4: Applied Statistics: (6 lectures)

Hypothesis testing: Test of significance, Large sample test for single proportion, difference of proportions, single mean, difference of means, and difference of standard deviations.

Suggested Text/Reference Books

(i) Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
(ii) P. G. Hoel, S. C. Port and C. J. Stone, Introduction to Probability Theory, Universal Book Stall, 2003 (Reprint).
(iii)S. Ross, A First Course in Probability, 6th Ed., Pearson Education India, 2002.
(iv)W. Feller, An Introduction to Probability Theory and its Applications, Vol. 1, 3rd Ed., Wiley, 1968.
(v) N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2010.
(vi)B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 35th Edition, 2000.
(vii) Veerarajan T., Engineering Mathematics (for semester III), Tata McGraw-Hill, New Delhi, 2010.

Semester -IV

Category	**Professional Core Courses**				
Course title	**Discrete Mathematics**				
Scheme and Credits	**L**	**T**	**P**	**Credit**	**Semester IV**
	3	1	-	4	
Pre-requisites (if any)	-				
Course Objective	Throughout the course, students will be expected to demonstrate their understanding of Discrete Mathematics by being able to do each of the following: 1. Use mathematically correct terminology and notation. 2. Construct correct direct and indirect proofs. 3. Use division into cases in a proof. 4. Use counterexamples. 5. Apply logical reasoning to solve a variety of problems.				
Course Outcomes	For a given logic sentence express it in terms of predicates, quantifiers, and logical connectives 1. For a given a problem, derive the solution using deductive logic and prove the solution based on logical inference 2. For a given a mathematical problem, classify its algebraic structure 3. Evaluate Boolean functions and simplify expressions using the properties of Boolean algebra 4. Develop the given problem as graph networks and solve with techniques of graph theory.				

Module 1:

Sets, Relation and Function: Operations and Laws of Sets, Cartesian Products, Binary Relation, Partial Ordering Relation, Equivalence Relation, Image of a Set, Sum and Product of Functions, Bijective functions, Inverse and Composite Function, Size of a Set, Finite and infinite Sets, Countable and uncountable Sets, Cantor's diagonal argument and The Power Set theorem, Schroeder-Bernstein theorem.

Principles of Mathematical Induction: The Well-Ordering Principle, Recursive definition, The Division algorithm: Prime Numbers, The Greatest Common Divisor: Euclidean Algorithm, The Fundamental Theorem of Arithmetic.

Module 2:

Basic counting techniques-inclusion and exclusion, pigeon-hole principle, permutation and combination.

Module 3:

Propositional Logic: Syntax, Semantics, Validity and Satisfiability, Basic Connectives and Truth Tables, Logical Equivalence: The Laws of Logic, Logical Implication, Rules of Inference, The use of Quantifiers. **Proof Techniques:** Some Terminology, Proof Methods and Strategies, Forward Proof, Proof by Contradiction, Proof by Contraposition, Proof of Necessity and Sufficiency.

Module 4:

Algebraic Structures and Morphism: Algebraic Structures with one Binary Operation, Semi Groups, Monoids, Groups, Congruence Relation and Quotient Structures, Free and Cyclic Monoids and Groups, Permutation Groups, Substructures, Normal Subgroups ,Algebraic Structures with two Binary Operation, Rings, Integral Domain and Fields. Boolean Algebra and Boolean Ring, Identities of BooleanAlgebra, Duality, Representation of Boolean Function, Disjunctive and Conjunctive Normal Form

Module 5:

Graphs and Trees: Graphs and their properties, Degree, Connectivity, Path, Cycle, Sub Graph, Isomorphism, Eulerian and Hamiltonian Walks, Graph Colouring, Colouring maps and Planar Graphs, Colouring Vertices, Colouring Edges, List Colouring, Perfect Graph, definition properties and Example, rooted trees, trees and sorting, weighted trees and prefix codes, Bi-connected component and Articulation Points, Shortest distances.

Suggested books :

1. Kenneth H. Rosen, Discrete Mathematics and its Applications, Tata McGraw – Hill
2. Susanna S. Epp, Discrete Mathematics with Applications,4th edition, Wadsworth Publishing Co. Inc.
3. C L Liu and D P Mohapatra, Elements of Discrete Mathematics A Computer Oriented Approach, 3rd Edition by, Tata McGraw – Hill.

Suggested reference books:

1. J.P. Tremblay and R. Manohar, Discrete Mathematical Structure and It's Application to Computer Science", TMG Edition, TataMcgraw-Hill
2. Norman L. Biggs, Discrete Mathematics, 2nd Edition, Oxford University Press. Schaum's Outlines Series, Seymour Lipschutz, Marc Lipson,
3. Discrete Mathematics, Tata McGraw - Hill

Category	**Engineering Science Course**				
Course title	**Computer Organization & Architecture**				
Scheme and Credits	**L**	**T**	**P**	**Credit**	**Semester IV**
	3	-	-	3	
Pre-requisites (if any)	-				
Course Objective	To expose the students to the following : 1. How Computer Systems work & the basic principles 2. Instruction Level Architecture and Instruction Execution 3. The current state of art in memory system design 4. How I/O devices are accessed and its principles. 5. To provide the knowledge on Instruction Level Parallelism 6. To impart the knowledge on micro programming 7. Concepts of advanced pipelining techniques.				
Course Outcomes	Draw the functional block diagram of a single bus **architecture of a computer and describe the function of the** instruction execution cycle, RTL interpretation of instructions, addressing modes, instruction set. 1. **Write** assembly language program for specified microprocessor for computing 16 bit multiplication,division and I/O device interface (ADC, Control circuit, serial port communication). 2. Write a flowchart for Concurrent access to memory and cache coherency in **Parallel Processors** and describe the process. 3. Given a CPU organization and instruction, design a memory module and analyze its operation by interfacing with the CPU. 4. Given a CPU organization, assess its performance, and apply design techniques to enhance performance using pipelining, parallelism and RISC methodology				

Module 1

Functional blocks of a computer: CPU, memory, input-output subsystems, control unit. Instruction set

architecture of a CPU – registers, instruction execution cycle, RTL interpretation of instructions, addressing modes, instruction set. Case study – instruction sets of some common CPUs.

Data representation: signed number representation, fixed and floating point representations, character representation. Computer arithmetic – integer addition and subtraction, ripple carry adder, carry look-ahead adder, etc. multiplication – shift-andadd, Booth multiplier, carry save multiplier, etc. Division restoring and non-restoring techniques, floating point arithmetic.

Module 2:

Introduction to x86 architecture.

CPU control unit design: hardwired and micro-programmed design approaches, Case study – design of a simple hypothetical CPU.

Memory system design: semiconductor memory technologies, memory organization. **Peripheral devices and their characteristics**: Input-output subsystems, I/O device interface, I/O transfers – program controlled, interrupt driven and DMA, privileged and non-privileged instructions, software interrupts and exceptions. Programs and processes – role of interrupts in process state transitions, I/O device interfaces – SCII, USB

Module 3:

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

Parallel Processors: Introduction to parallel processors, Concurrent access to memory and cache coherency.

Module 4:

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

Suggested books:

1. " Computer Organization and Design: The Hardware/Software Interface" , 5th Edition by David A. Patterson and John L. Hennessy, Elsevier.
2. " Computer Organization and Embedded Systems" , 6th Edition by CarlHamacher, McGraw Hill Higher Education.

Suggested reference books:

1. " Computer Architecture and Organization", 3rd Edition by John P. Hayes, WCB/McGraw-Hill
2. " Computer Organization and Architecture: Designing for Performance" , 10th Edition by William Stallings, Pearson Education.
3. " Computer System Design and Architecture", 2nd Edition by Vincent P. Heuring and Harry F. Jordan, Pearson Education.

Category	**Professional Core Courses**				
Course title	**Operating Systems**				
Scheme and Credits	**L**	**T**	**P**	**Credit**	**Semester IV**
	3	-	-	3	
Pre-requisites (if any)	-				
Course Objective	To learn the fundamentals of Operating Systems. 1. To learn the mechanisms of OS to handle processes and threads and their communication 2. To learn the mechanisms involved in memory management in contemporary OS 3. To gain knowledge on distributed operating system concepts that includes architecture, Mutual exclusion algorithms, deadlock detection algorithms and agreement protocols 4. To know the components and management aspects of concurrency management				
Course Outcomes	● Create processes and threads. ● Develop algorithms for process scheduling for a given specification of CPU utilization, Throughput, Turnaround Time, Waiting Time, Response Time. ● For a given specification of memory organization develop the techniques for optimally allocating memory to processes by increasing memory utilization and for improving the access time. ● Design and implement file management system. ● For a given I/O devices and OS (specify) develop the I/O management functions in OS as part of a uniform device abstraction by performing operations for synchronization between CPU and I/O controllers.				

Module 1:

Introduction: Concept of Operating Systems, Generations of Operating systems, Types of Operating Systems, OS Services, System Calls, Structure of an OS - Layered, Monolithic, Microkernel Operating Systems, Concept of Virtual Machine. Case study on UNIX and WINDOWS Operating System.

Module 2:

Processes: Definition, Process Relationship, Different states of a Process, Process State transitions,

Process Control Block (PCB), Context switching

Thread: Definition, Various states, Benefits of threads, Types of threads, Concept of multithreads,

Process Scheduling: Foundation and Scheduling objectives, Types of Schedulers, Scheduling criteria: CPU utilization, Throughput, Turnaround Time, Waiting Time, Response Time; Scheduling algorithms: Pre-emptive and Non pre-emptive, FCFS, SJF, RR; Multiprocessor scheduling: Real Time scheduling: RM and EDF.

Module 3:

Inter-process Communication: Critical Section, Race Conditions, Mutual Exclusion, Hardware Solution, Strict Alternation, Peterson's Solution, The Producer\ Consumer Problem, Semaphores, Event Counters, Monitors, Message Passing, Classical IPC Problems: Reader's & Writer Problem, Dinning Philosopher Problem etc.

Module 4:

Deadlocks: Definition, Necessary and sufficient conditions for Deadlock, Deadlock Prevention, Deadlock Avoidance: Banker's algorithm, Deadlock detection and Recovery.

Module 5:

Memory Management: Basic concept, Logical and Physical address map, Memory allocation: Contiguous Memory allocation – Fixed and variable partition– Internal and External fragmentation and Compaction; Paging: Principle of operation – Page allocation – Hardware support for paging, Protection and sharing, Disadvantages of paging.

Virtual Memory: Basics of Virtual Memory – Hardware and control structures – Locality of reference, Page fault , Working Set , Dirty page/Dirty bit – Demand paging, Page Replacement algorithms: Optimal, First in First Out (FIFO), Second Chance (SC), Not recently used (NRU) and Least Recently used (LRU).

Module 6:

I/O Hardware: I/O devices, Device controllers, Direct memory access Principles of I/O Software: Goals of Interrupt handlers, Device drivers, Device independent I/O software, Secondary-Storage Structure: Disk structure, Disk scheduling algorithms

File Management: Concept of File, Access methods, File types, File operation, 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 and performance.**Disk Management:** Disk structure, Disk scheduling - FCFS, SSTF, SCAN, C-SCAN, Disk reliability, Disk formatting, Boot-block, Bad blocks

Suggested books:

1. Operating System Concepts Essentials, 9th Edition by AviSilberschatz, Peter Galvin, Greg Gagne, Wiley Asia Student Edition.
2. Operating Systems: Internals and Design Principles, 5th Edition, William Stallings, Prentice Hall of India.

Suggested reference books:

1. Operating System: A Design-oriented Approach, 1st Edition by Charles Crowley, Irwin Publishing
2. Operating Systems: A Modern Perspective, 2nd Edition by Gary J. Nutt, Addison-Wesley
3. Design of the Unix Operating Systems, 8th Edition by Maurice Bach, Prentice-Hall of India

4. Understanding the Linux Kernel, 3rd Edition, Daniel P. Bovet, Marco Cesati, O'Reilly and Associates

Category	**Professional Core Courses**				
Course title	**Design and Analysis of Algorithms**				
Scheme and Credits	**L**	**T**	**P**	**Credit**	**Semester IV**
	3	-	-	3	
Pre-requisites (if any)	-				
Course Objective	● Analyze the asymptotic performance of algorithms. ● Write rigorous correctness proofs for algorithms. ● Demonstrate a familiarity with major algorithms and data structures. ● Apply important algorithmic design paradigms and methods of analysis. ● Synthesize efficient algorithms in common engineering design situations.				
Course Outcomes	1. For a given algorithms analyze worst-case running times of algorithms based on asymptotic analysis and justify the correctness of algorithms . 2. Describe the greedy paradigm and explain when an algorithmic design situation calls for it. For a given problem develop the greedy algorithms. 3. Describe the divide-and-conquer paradigm and explain when an algorithmic design situation calls for it. Synthesize divide-and-conquer algorithms. Derive and solve recurrence relation. 4. Describe the dynamic-programming paradigm and explain when an algorithmic design situation calls for it. For a given problems of dynamic-programming and develop the dynamic programming algorithms, and analyze it to determine its computational complexity. 5. For a given model engineering problem model it using graph and write the corresponding algorithm to solve the problems. 6. Explain the ways to analyze randomized algorithms (expected running time, probability of error). Explain what an approximation algorithm is. Compute the approximation factor of an approximation algorithm (PTAS and FPTAS).				

Module 1:

Introduction: Characteristics of algorithm. Analysis of algorithm: Asymptotic analysis of complexity bounds – best, average and worst-case behavior; Performance measurements of Algorithm, Time and space trade-offs, Analysis of recursive algorithms through recurrence relations: Substitution method, Recursion tree method and Masters' theorem.

Module 2:

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, Knap Sack TSP. Heuristics – characteristics and their application domains.

Module 3:

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

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

Suggested books:

1. Introduction to Algorithms, 4TH Edition, Thomas H Cormen, Charles E Lieserson, Ronald L Rivest and Clifford Stein, MIT Press/McGraw-Hill.
2. Fundamentals of Algorithms – E. Horowitz et al.

Suggested reference books

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

Category	Humanities & Social Sciences including Management courses				
Course title	**Finance and Accounting Management**				
Scheme and Credits	**L**	**T**	**P**	**Credit**	**Semester IV**
	3	-	-	3	
Pre-requisites (if any)	-				
Course Objective	● To enable the students to gain knowledge about Accountancy & Finance. ● To improve the financial thinking skills of students. ● To develop students ability to identify and evaluate accounting problems and arrive at reasoned conclusions.				
Course Outcomes	The students will be able to: ● Identify the main financial statements and their purposes. ● Complete a Project/ Written Assignment that integrates career orientation and or professional development skills. ● Develop the ability to use accounting information to solve a variety of business problems. The course will help understand and learn the				

Module 1:

1.1Financial Management
Meaning, Objectives, Need and Importance, Finance Functions, sources of Finance etc.
1.2 Personal Finance
Introduction, Goals, Financial Planning, Saving & Investment, Avenues for Investment.

1.3Subsidiary Books:
Meaning ,Need and Types of subsidiary Books Purchase Book, Sales Book, Purchase Return Book, Sales Return Book, Simple Cash Book with only cash Column

Module 2:

2.1. Final Accounts of a Proprietary Concern

Preparation of Trading Account, Profit and Loss Account and Balance Sheet with Adjustment like: Closing Stock, Outstanding Expenses, Prepaid Expenses, Outstanding Income, Income received in Advance, Depreciation, Treatment of Reserve for Bad & Doubtful Debts, Goods Withdrawn for Personal Use Goods Distributed as free Sample, Interest on Bank Loan & Investments

2.2. Goods and Service Tax(GST)

Meaning, Need and Importance, advantage of GST,Basic Practical Sums, GST Features ,CGST SGST,IGST, Tax Rate structure & invoicing, Refund of Tax,GST Reports & Payment,GST Challan ,VAT,TDS

Module 3:

3.1Introduction of Book keeping and Accountancy

Accounting Terminologies, Double Entry Book- Keeping system, Types of Vouchers & Specimen of vouchers

3.2Journal:

Meaning, Importance and Utility of Journal Specimen of Journal: Writing of Journal Entries on the basis of vouchers

3.3Ledger:

Meaning, Need and Specimen of Ledger Posting of Entries from Journal to Ledger

Module 4:

4.1 Introduction to GNUKhata /Tally Software: Basic of Accounting , Tally Fundamentals, Ledger creation, Purchase & Sales

4.2. DATA & PAYROLL: Data Backup, Export & Import Data, Cheaque Printing, Interest Calculation, Multi-Currency, Security Control ,Payroll

REFERENCE BOOKS:

1) Dr.H.C.Mehrotra, & Prof.V.P.Agarwal. (2019). *Goods and service Tax.* Sahitya Bhawan Publications.
2) R.S.N.Pillai Bagavathi , (2018),Maganement Acccounting,Chand Publications.
3) Ainapure Ainapure,(2018), Maganement Acccounting Volume I,Manan Prakashan.
4) Nadhani, A. K. (2018). *GST Accounting with Tally.* BPB Publication.
5) S.T.Pawar, & Members, C. (2018). *Book Keeping and Accountancy.* Pune: Maharashtra State Board of Secondary and Higher Secondary Education.
6) Goel, D. K., & Goel, R. (2017). *Problem & Solution in Accountancy.* Arya Publications.
7) Chaudhary, Choppde, Ms. Toral Juthani, & S.S.Sonawane. (2016). *Book Keeping and Accountancy.*
8) Choudhari, & Chopde. (2014). *Book Keeping & Accountancy.* Seth Publications.
9) Kishnadwala. (2001). *Book Keeping and Accountancy.* Manisha Prakashna.

Mandatory Course

Constitution of India – Basic features and fundamental principles

The Constitution of India is the supreme law of India. Parliament of India can not make any law which violates the Fundamental Rights enumerated under the Part III of the Constitution. The Parliament of India has been empowered to amend the Constitution under Article 368, however, it cannot use this power to change the "basic structure" of the constitution, which has been ruled and explained by the Supreme Court of India in its historical judgments. The Constitution of India reflects the idea of "Constitutionalism" – a modern and progressive concept historically developed by the thinkers of "liberalism" – an ideology which has been recognized as one of the most popular political ideology and result of historical struggles against arbitrary use of sovereign power by state. The historic revolutions in France, England, America and particularly European Renaissance and Reformation movement have resulted into progressive legal reforms in the form of "constitutionalism" in many countries. The Constitution of India was made by borrowing models and principles from many countries including United Kingdom and America.

The Constitution of India is not only a legal document but it also reflects social, political and economic perspectives of the Indian Society. It reflects India's legacy of "diversity". It has been said that Indian constitution reflects ideals of its freedom movement, however, few critics have argued that it does not truly incorporate our own ancient legal heritage and cultural values. No law can be "static" and therefore the Constitution of India has also been amended more than one hundred times. These amendments reflect political, social and economic developments since the year 1950. The Indian judiciary and particularly the Supreme Court of India has played an historic role as the guardian of people. It has been protecting not only basic ideals of the Constitution but also strengthened the same through progressive interpretations of the text of the Constitution. The judicial activism of the Supreme Court of India and its historic contributions has been recognized throughout the world and it gradually made it "as one of the strongest court in the world".

Course content

1. Meaning of the constitution law and constitutionalism
2. Historical perspective of the Constitution of India
3. Salient features and characteristics of the Constitution of India
4. Scheme of the fundamental rights
5. The scheme of the Fundamental Duties and its legal status
6. The Directive Principles of State Policy – Its importance and implementation
7. Federal structure and distribution of legislative and financial powers between the Union and the States
8. Parliamentary Form of Government in India – The constitution powers and status of the President of India

9. Amendment of the Constitutional Powers and Procedure
10. The historical perspectives of the constitutional amendments in India
11. Emergency Provisions: National Emergency, President Rule, Financial Emergency
12. Local Self Government – Constitutional Scheme in India
13. Scheme of the Fundamental Right to Equality
14. Scheme of the Fundamental Right to certain Freedom under Article 19
15. Scope of the Right to Life and Personal Liberty under Article 21

USHA MITTAL INSTITUTE OF TECHNOLOGY

(umit.ac.in)

SNDT Women's University

(Sndt.digitaluniversity.ac)

Syllabus B. Tech.
CST Syllabus

SNDT Women's University

1, Nathibai Thackersey Road,
Mumbai 400 020

(Applicable to students taking admission in and after 2019)

Credit Definition

1 Hr. Lecture (L) per week	1 credit
1 Hr. Tutorial (T) per week	1 credit
1 Hr. Practical (P) per week	0.5 credits
2 Hours Practical(Lab)/week	1 credit

Range of credits –

- Credits of 160-163 for a student to be eligible to get an Undergraduate degree in Computer Science and Technology(CST).
- A student will be eligible to get an Undergraduate degree with **Minor Engineering, if she completes an additional 18-20 credits. These could be acquired through MOOCs offered at Institutes or approved by the department designed internally or with other agencies in the Institute.**

Course code and Definition:

Course Code	Definitions
L	Lecture
T	Tutorial
P	Practical
D	Duration of Paper
TP	Term Paper
TW	Term Work
P/V	Practical/Viva
BSC	Basic Science Courses
ESC	Engineering Science Courses
HSMC	Humanities and Social Sciences including Management courses
PCC	Professional core courses
PEC	Professional Elective courses

OEC	Open Elective courses
LC	Laboratory course
MC	Mandatory courses
PROJ	Project

Non-credit subject Passing Mandatory. A total of 16 hours needs to be completed.
Humanities Elective: MOOC based courses have to be completed. Certificate has to be provided by individual students to get evaluated.

Minor Degree Course

Students can choose from

Minor Degree in Blockchain

Minor Degree in Cyber Security

Minor Degree in Internet of Things (IoT)

Minor Degree in Robotics

Minor Degree in Virtual and Augmented Reality

USHA MITTAL INSTITUTE OF TECHNOLOGY
SNDT Women's University
Faculty : Technology (Undergraduate Course) -BTech

SCHEME: Semester V

Category and Code	Course title	Hours per Week			Cr	D	TP	TW	P/V	Total
		L	T	P						
Engineering Science Course ESC501	Signals & Systems	3	0	0	3	2.5	75	25		100
Professional Core Courses PCC- CS501	Database Management Systems	3	0	-	3	2.5	75	25		100
Professional Core Courses PCC- CS502	Formal Language & Automata Theory	3	0	0	3	2.5	75	25		100
Professional Core Courses	Object-Oriented Programming	3	0	-	3	2.5	75	25		100
Professional Elective courses	Elective-I	3	0	0	3	2.5	75	25		100
Mandatory Courses MC	Essence of Indian Knowledge Tradition	-	-	-	0	-	25	25	PV	50
	Signals & Systems Lab			2	1	-		25	PV	25
	Database Management Systems Lab			2	1	-		25	PV	25
	Formal Language & Automata Theory Lab			2	1	-		25	PV	25
	Object Oriented Programming Lab			2	1	-		25	PV	25
	Elective-I Lab			2	1	-		25	PV	25
MD	Minor Degree Subjects		-							
	Total	15	0	10	20					675

Non-credit subject Passing Mandatory. A total of 16 hours needs to be completed.
Humanities Elective: MOOC based courses have to be completed. Certificate has to be provided by individual students to get evaluated.

USHA MITTAL INSTITUTE OF TECHNOLOGY
SNDT Women's University
Faculty : Technology (Undergraduate Course) -BTech

SCHEME: Semester VI

Category and Code	Course title	Hours per Week			Cr	D	TP	TW	P/V	Total
		L	T	P						
Professional Core Courses PCC	Complier Design	3	0	-	3	2.5	75	25		100
Professional Core Courses PCC	Computer Networks	3	0	-	3	2.5	75	25		100
Professional Elective courses PEC	Elective-II	3	0	0	3	2.5	75	25		100
Professional Elective courses PEC	Elective-III	3	0	0	3	2.5	75	25		100
Open Elective courses OEC	Open Elective-I Object Oriented modeling and design	3	0	0	3	2.5	75	25		100
Project	Project-1	0	0	4	2	-	-	50	PV	50
	Complier Design Lab			2	1	-		25	PV	25
	Computer Networks Lab			2	1	-		25	PV	25
	Elective-II Lab			2	1	-		25	PV	25
	Elective-III Lab			2	1	-		25	PV	25
	UML wih Java Lab			2	1			25	PV	25
MD	Minor Degree Subjects		-							
	Total	15	0	14	22					675

Non-credit subject Passing Mandatory. A total of 16 hours needs to be completed.
Humanities Elective: MOOC based courses have to be completed. Certificate has to be provided by individual students to get evaluated.

Elective I	**Elective II**	**Elective III**	**Elective IV**	**Elective V**	**Elective VI**
Software Engineering	Artificial Intelligence	Neural network and Deep learning	Cryptographic and network Security	Cloud Computing	Computational Data Analytics
Web and Internet	web Data Mining	Soft Computing	Human computer interaction	Parallel and distributed algorithm	Ad-Hoc Sensor Networks
Information Retriever	Multi-agent Intelligent	Optimization Techniques	Quantum Computing		High Performance Computing

Open Elective-I	**Open Elective-II**	**Open Elective-III**	**Open Elective-IV**
Object oriented modelling and design	soft skill and Interpersonal Communication	History of Science and Engineering	Cyber law and Ethics
Introduction to Philosophical Thoughts	Human Resource Development and Organizational Behavior	Comparative Study of Literature	Economic Polices in India

	USHA MITTAL INSTITUTE OF TECHNOLOGY **SNDT Women's University** **Faculty : Technology (Undergraduate Course) -BTech**	

Course code						
Category	**Core Course (CST)**					
Course title	**Signals and Systems**					
Scheme and Credits	**L**	**T**	**P**	**Credit**	**Semester V**	
	3	**0**	**2**	**4**		
Pre-requisites (if any)						
Course Objective	**The students will be able to** ●					
Course Outcomes	**At the end of this course students will demonstrate the ability to** ● Understand the concepts of continuous time and discrete time systems. ● Analyse systems in complex frequency domain. ● Understand sampling theorem and its implications.					

Module No.	**Sr. No**	**Topic and Details**	**No. of Hours assigned**	**Weightage in %**
I	**1**	**Introduction to Signals and Systems (3 hours):** Signals and systems as seen in everyday life, and in various branches of engineering and science. Signal properties: periodicity, absolute integrability, determinism and stochastic character. Some special signals of importance: the unit step, the unit impulse, the sinusoid, the complex exponential, some special time-limited signals; continuous and discrete time signals, continuous and discrete amplitude signals. System properties: linearity: additivity and homogeneity, shift-invariance, causality, stability, realizability. Examples.	**10**	**25%**
II	**1**	**Behavior of continuous and discrete-time LTI systems (8 hours)** Impulse response and step response, convolution, input-output behavior with aperiodic convergent inputs, cascade interconnections. Characterization of causality and	**10**	**25%**

		stability of LTI systems. System representation through differential equations and difference equations. State-space Representation of systems. State-Space Analysis, Multi-input, multi-output representation. State Transition Matrix and its Role. Periodic inputs to an LTI system, the notion of a frequency response and its relation to the impulse response.		
III	**1**	**Fourier, Laplace and z- Transforms (10 hours)** Fourier series representation of periodic signals, Waveform Symmetries, Calculation of Fourier Coefficients. Fourier Transform, convolution/multiplication and their effect in the frequency domain, magnitude and phase response, Fourier domain duality. The Discrete-Time Fourier Transform (DTFT) and the Discrete Fourier Transform (DFT). Parseval's Theorem. Review of the Laplace Transform for continuous time signals and systems, system functions, poles and zeros of system functions and signals, Laplace domain analysis, solution to differential equations and system behavior. The z-Transform for discrete time signals and systems, system functions, poles and zeros of systems and sequences, z-domain analysis.	**10**	**25%**
IV	**1**	**Sampling and Reconstruction (4 hours)** The Sampling Theorem and its implications. Spectra of sampled signals. Reconstruction: ideal interpolator, zero-order hold, first-order hold. Aliasing and its effects. Relation between continuous and discrete time systems. Introduction to the applications of signal and system theory: modulation for communication, filtering, feedback control systems.	**10**	**25%**

Text/References:

1. A. V. Oppenheim, A. S. Willsky and S. H. Nawab, "Signals and systems", Prentice Hall India, 1997.

2. J. G. Proakis and D. G. Manolakis, "Digital Signal Processing: Principles, Algorithms, and Applications", Pearson, 2006.

3. H. P. Hsu, "Signals and systems", Schaum's series, McGraw Hill Education, 2010.

4. S. Haykin and B. V. Veen, "Signals and Systems", John Wiley and Sons, 2007.

5. A. V. Oppenheim and R. W. Schafer, "Discrete-Time Signal Processing", Prentice Hall, 2009.

6. M. J. Robert "Fundamentals of Signals and Systems", McGraw Hill Education, 2007.

7. B. P. Lathi, "Linear Systems and Signals", Oxford University Press, 2009

	USHA MITTAL INSTITUTE OF TECHNOLOGY **SNDT Women's University** **Faculty : Technology (Undergraduate Course) -BTech**	

Course code						
Category	**Core Course (CST)**					
Course title	**Database Management System**					
Scheme and Credits	**L**	**T**	**P**	**Credit**	**Semester V**	
	3	**0**	**2**	**4**		
Pre-requisites (if any)						
Course Objective	**The students will be able to** • **To understand the different issues involved in the design and implementation of a database system.** • **To study the physical and logical database designs, database modeling, relational, hierarchical, and network models** • **To understand and use data manipulation language to query, update, and manage a database** • **To develop an understanding of essential DBMS concepts such as: database security, integrity, concurrency, distributed database, and intelligent database, Client/Server (Database Server), Data Warehousing.** • **To design and build a simple database system and demonstrate competence with the fundamental tasks involved with modeling, designing, and implementing a DBMS.**					
Course Outcomes	**At the end of this course students will demonstrate the ability to** • **For a given query write relational algebra expressions for that query and optimize the developed expressions.** • **For a given specification of the requirement design the databases using E-R method and normalization.** • **For a given specification construct the SQL queries for Open source and Commercial DBMS -MYSQL, ORACLE, and DB2.** • **For a given query, optimize its execution using Query optimization algorithms.** • **For a given transaction-processing system, determine the transaction atomicity, consistency, isolation, and durability.** • **Implement the isolation property, including locking, time stamping based on concurrency control and Serializability of scheduling.**					

	USHA MITTAL INSTITUTE OF TECHNOLOGY **SNDT Women's University** **Faculty : Technology (Undergraduate Course) -BTech**	

Module No.	Sr. No	Topic and Details	No. of Hours assigned	Weightage in %
I	**1**	**Database system architecture:** Data Abstraction, Data Independence, Data Definition Language (DDL), Data Manipulation Language (DML). **Data models:** Entity-relationship model, network model, relational and object oriented data models, integrity constraints, data manipulation operations.	**10**	**25%**
II	**1**	**Relational query languages:** Relational algebra, Tuple and domain relational calculus, SQL3, DDL and DML constructs, Open source and Commercial DBMS - MYSQL, ORACLE, DB2, SQL server. **Relational database design:** Domain and data dependency, Armstrong's axioms, Normal forms, Dependency preservation, Lossless design. **Query processing and optimization:** Evaluation of relational algebra expressions, Query equivalence, Join strategies, Query optimization algorithms.	**10**	**25%**
III	**1**	**Storage strategies:** Indices, B-trees, hashing. **Transaction processing:** Concurrency control, ACID property, Serializability of scheduling, Locking and timestamp based schedulers, Multi-version and optimistic Concurrency Control schemes, Database recovery.	**10**	**25%**
IV	**1**	**Database Security:** Authentication, Authorization and access control, DAC, MAC and RBAC models, Intrusion detection, SQL injection. **Advanced topics:** Object oriented and object relational databases, Logical databases, Web databases, Distributed databases, Data warehousing and data mining.	**10**	**25%**
Total			**40**	**100**

Suggested books: 1. "Database System Concepts", 6th Edition by Abraham Silberschatz, Henry F. Korth, S. Sudarshan, McGraw-Hill.

Suggested reference books

1 "Principles of Database and Knowledge – Base Systems", Vol 1 by J. D. Ullman, Computer Science Press.

2 "Fundamentals of Database Systems", 5th Edition by R. Elmasri and S. Navathe, Pearson Education
3 "Foundations of Databases", Reprint by Serge Abiteboul, Richard Hull, Victor Vianu, Addison-Wesley

	USHA MITTAL INSTITUTE OF TECHNOLOGY **SNDT Women's University** **Faculty : Technology (Undergraduate Course) -BTech**	

Course code					
Category	**Core Course (CST)**				
Course title	**Formal Language and Automata Theory**				
Scheme and Credits	**L**	**T**	**P**	**Credit**	**Semester V**
	3	**0**	**2**	**4**	
Pre-requisites (if any)					
Course Objective	**The students will be able to** ● **Develop a formal notation for strings, languages and machines.** ● **Design finite automata to accept a set of strings of a language.** ● **Prove that a given language is regular and apply the closure properties of languages.** ● **Design context free grammars to generate strings from a context free language and convert them into normal forms.** ● **Prove equivalence of languages accepted by PushDown Automata and languages generated by context free grammars.** ● **Identify the hierarchy of formal languages, grammars and machines.** ● **Distinguish between computability and non-computability and Decidability and undecidability**				
Course Outcomes	**At the end of this course students will demonstrate the ability to** ● **Write a formal notation for strings, languages and machines.** ● **Design finite automata to accept a set of strings of a language.** ● **For a given language determine whether the given language is regular or not.** ● **Design context free grammars to generate strings of context free language .** ● **Determine equivalence of languages accepted by Push Down Automata and languages generated by context free grammars.** ● **Write the hierarchy of formal languages, grammars and machines.** ● **Distinguish between computability and non-computability and Decidability and undecidability.**				

Module No.	**Sr. No**	**Topic and Details**	**No. of Hours assigned**	**Weightage in %**
I	**1**	Introduction: Alphabet, languages and grammars, productions and derivation, Chomsky hierarchy of languages.	**10**	**25%**

II	**1**	Regular languages and finite automata: Regular expressions and languages, deterministic finite automata (DFA) and equivalence with regular expressions, nondeterministic finite automata (NFA) and equivalence with DFA, regular grammars and equivalence with finite automata, properties of regular languages, pumping lemma for regular languages, minimization of finite automata.	**10**	**25%**
III	**1**	Context-free languages and pushdown automata: Context-free grammars (CFG) and languages (CFL), Chomsky and Greibach normal forms, nondeterministic pushdown automata (PDA) and equivalence with CFG, parse trees, ambiguity in CFG, pumping lemma for context-free languages, deterministic pushdown automata, closure properties of CFLs. Context-sensitive languages: Context-sensitive grammars (CSG) and languages, linear bounded automata and equivalence with CSG.	**10**	**25%**
IV	**1**	Turing machines: The basic model for Turing machines (TM), Turing-recognizable (recursively enumerable) and Turing-decidable (recursive) languages and their closure properties, variants of Turing machines, nondeterministic TMs and equivalence with deterministic TMs, unrestricted grammars and equivalence with Turing machines, TMs as enumerators. Undecidability: Church-Turing thesis, universal Turing machine, the universal and diagonalization languages, reduction between languages and Rice s theorem, undecidable problems about languages.	**10**	**25%**
Total			**40**	**100**

Suggested books:

1. John E. Hopcroft, Rajeev Motwani and Jeffrey D. Ullman, Introduction to Automata Theory, Languages, and Computation, Pearson Education Asia.

Suggested reference books:

1. Harry R. Lewis and Christos H. Papadimitriou, Elements of the Theory of Computation, Pearson Education Asia.
2. Dexter C. Kozen, Automata and Computability, Undergraduate Texts in Computer Science, Springer.
3. Michael Sipser, Introduction to the Theory of Computation, PWS Publishing.
4. John Martin, Introduction to Languages and The Theory of Computation, Tata McGraw Hill

	USHA MITTAL INSTITUTE OF TECHNOLOGY **SNDT Women's University** **Faculty : Technology (Undergraduate Course) -BTech**	

Course code					
Category	**Core Course (CST)**				
Course title	**Object Oriented Programming**				
Scheme and Credits	**L**	**T**	**P**	**Credit**	**Semester V**
	3	**0**	**2**	**4**	
Pre-requisites (if any)					
Course Objective	**The students will be able to** ● **The course will introduce standard tools and techniques for software development, using object oriented approach, use of a version control system, an automated build process, an appropriate framework for automated unit and integration tests.**				
Course Outcomes	**At the end of this course students will demonstrate the ability to** ● **Specify simple abstract data types and design implementations, using abstraction functions to document them.** ● **Recognise features of object-oriented design such as encapsulation, polymorphism, inheritance, and composition of systems based on object identity.** ● **Name and apply some common object-oriented design patterns and give examples of their use.** ● **Design applications with an event-driven graphical user interface.**				

Module No.	**Sr. No**	**Topic and Details**	**No. of Hours assigned**	**Weightage in %**
I	**1**	Introduction, Tokens, expression, and control structures, Operators in C++. Console I/O Streams, predefined streams, hierarchy of stream classes, unformatted and formatted console I/O operations, user defined manipulators, insertion and extraction, operators. Functions in C++ parameter passing techniques such as call by value, call by address, and call by reference, return by reference, inline functions, default arguments, function overloading, function overriding. Pointers pointer definition, de-referencing of pointer, parameter passing, void pointer, precedence of * and [ ] operators, pointer to function, pointer to constant object, constant pointer, wild pointers. Classes and objects Introduction to classes and objects, programming with member functions and classes, access specifiers such as public, protected, and private. Classes and objects constant member function, static data members, friend function, and friend classes. Classes and objects static member functions, local	**10**	**25%**

		classes.		
II	**1**	Constructor and destructor Definition of constructor and destructor, benefits of constructors, default constructor, default argument constructor, dynamic initialization, dynamic constructor, copy constructor, parameterized constructor, constructor overloading, constant objects. Constructor and destructor dynamic objects, pointer to object definition, creation and deletion of dynamic objects, reference to an object, live objects, array of objects, pointer to object members, accessing members through objects, and object pointers, function set_new_handler ( ), this pointer Operator overloading Operator overloading, rules for overloading operators, syntax, process of operator overloading, unary operator overloading, binary operator overloading, Data conversion conversion between user defined data type to basic data type, conversion between basic data type to user defined data type, overloading of special operator such as subscript, function call, member access, comma, assignment, new and delete operators, overloading with friend functions, benefits of operator overloading	**10**	**25%**
III	**1**	Inheritance Introduction, derived class declaration, visibility of class members, different types of inheritances such as single, multiple, hierarchical, multilevel, hybrid, multipath, inheritance and member accessibility, constructor in derived class, order of invocation of constructor. Inheritance destructor in derived class, constructor invocation and data member initialization, ambiguity in member access, virtual base class, object composition and delegation, relationship between classes such as is-kind-of, is analogous-of, and is-part-of. Virtual Function Introduction, pointer to derived class, array of pointers to derived class, pure virtual function, abstract class, virtual destructors, dynamic binding. Generic programming Introduction, generic functions, syntax, overloading function template, class template, syntax, class template with multiple arguments Generic programming , inheritance of class template, class template containership, class template with overloaded operators.	**10**	**25%**
IV	**1**	File Handling Introduction, classes for stream operation, opening and closing of file File Handling file I/O with fstream classes, file pointer manipulators, file modes.Coupling and Cohesion, Collaborations. Exception Handling Different techniques of building reliable models such as fault avoidance and fault tolerance, error handling, types of exceptions such as synchronous and asynchronous, exception handling model, exception handling constructs such as throw, catch, and try, handler throwing same exception again, list of exceptions, raising an unspecified exception, exceptions in no exception function Exception Handling catch all exceptions, method of handling uncaught exceptions, exception in constructors, destructors, operator overloaded function, inheritance tree, and class template, fault tolerant design techniques such as N-version programming and recovery block. Relation of C++ with	**10**	**25%**

		other programming languages. Connectivity of C++ with other languages. Introduction of other high level languages.		
Total			**40**	**100**

Suggested books

1.Venugopal, Rajkumar, Ravishankar, "Mastering C++", Tata McGraw Hill, 2001. (Rs.235/-)

2.. Barbara Liskov, Program Development in Java, Addison-Wesley, 2001

Suggested reference books

1. Any book on Core Java

2. Any book on C++

Course code					
Category	**Core Course (CST)**				
Course title	**Elective-I (Software Engineering)**				
Scheme and Credits	**L**	**T**	**P**	**Credit**	**Semester V**
	3	**0**	**2**	**4**	
Pre-requisites (if any)					
Course Objective	**The students will be able to** ● **In this course, students will gain a broad understanding of the discipline of software engineering and its application to the development and management of software systems.** ● **Knowledge of basic SW engineering methods and practices, and their appropriate application.** ● **A general understanding of software process models such as the waterfall and evolutionary models.** ● **An understanding of the role of project management including planning, scheduling, risk management, etc.** ● **An understanding of software requirements and the SRS document, architectural styles.** ● **An understanding of implementation issues such as modularity and coding standards. An understanding of approaches to verification and validation including static analysis, reviews and testing.**				

	USHA MITTAL INSTITUTE OF TECHNOLOGY **SNDT Women's University** **Faculty : Technology (Undergraduate Course) -BTech**	

Course Outcomes	**At the end of this course students will demonstrate the ability to** •

Module No.	Sr. No	Topic and Details	No. of Hours assigned	Weightage in %
I	**1**	**Introduction to Software Engineering:** The evolving role of software, changing nature of software, software myths. A Generic view of process: Software engineering- a layered technology, a process framework, the capability maturity model integration (CMMI), process patterns, process assessment, personal and team process models. Process models: The waterfall model, incremental process models, evolutionary process models, the unified process.	**10**	**25%**
II	**1**	**Software Requirements:** Functional and non-functional requirements, user requirements, system requirements, interface specification, the software requirements document. Requirements engineering process: Feasibility studies, requirements elicitation and analysis, requirements validation, requirements management. System models: Context models, behavioral models, data models, object models, structured methods. **Design Engineering:** Design process and design quality, design concepts, the design model. Creating an architectural design: software architecture, data design, architectural styles and patterns, architectural design,.	**10**	**25%**
III	**1**	**Testing Strategies:** A strategic approach to software testing, test strategies for conventional software, black-box and white-box testing, validation testing, system testing, the art of debugging. Product metrics: Software quality, metrics for analysis model,metrics for design model, metrics for source code, metrics for testing, metrics for maintenance.	**10**	**25%**
IV	**1**	**Metrics for Process and Products:** Software measurement, metrics for software quality. Risk management: Reactive Vs	**10**	**25%**

		proactive risk strategies, software risks, risk identification, risk projection, risk refinement, RMMM, RMMM plan. **Quality Management:** Quality concepts, software quality assurance, software reviews, formal technical reviews, statistical software quality assurance, software reliability, the ISO 9000 quality standards.		
Total			**40**	**100**

Suggested Books:

1. Software Engineering, A practitioner's Approach- Roger S. Pressman, 6th edition, Mc Graw Hill International Edition.

2. Software Engineering- Sommerville, 7th edition, Pearson Education.

Suggested Reference books:

1. Software Engineering, an Engineering approach- James F. Peters, Witold Pedrycz, John Wiley.

2. Software Engineering principles and practice- Waman S Jawadekar, The Mc Graw-Hill Companies.

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Course code						
Category	**Core Course (CST)**					
Course title	**Compiler Design**					
Scheme and Credits	**L**	**T**	**P**	**Credit**	**Semester VI**	
	3	**-**	**2**	**4**		
Pre-requisites (if any)						
Course Objective	**The students will be able to** ● **To understand and list the different stages in the process of compilation.** ● **Identify different methods of lexical analysis.** ● **Design top-down and bottom-up parsers.** ● **Identify synthesized and inherited attributes.** ● **Develop syntax directed translation schemes .** ● **Develop algorithms to generate code for a target machine.**					
Course Outcomes	**At the end of this course students will demonstrate the ability to** ● **For a given grammar specification develop the lexical analyser** ● **For a given parser specification design top-down and bottom-up parsers** ● **Develop syntax directed translation schemes** ● **Develop algorithms to generate code for a target machine**					

Module No.	**Sr. No**	**Topic and Details**	**No. of Hours assigned**	**Weightage in %**
I	**1**	The aim is to learn how to design and implement a compiler and also to study the underlying theories. The main emphasis is for the imperative language. Introduction: Phases of compilation and overview. Lexical Analysis (scanner): Regular languages, finite automata, regular expressions, from regular expressions to finite automata, scanner generator (lex, flex).	**10**	**25%**
II	**1**	Syntax Analysis (Parser): Context-free languages and grammars, push-down automata, LL(1) gram-mars and top-down parsing, operator grammars, LR(O), SLR(1), LR(1), LALR(1) grammars and bottom-up parsing, ambiguity and LR parsing, LALR(1) parser generator (yacc, bison)	**10**	**25%**
III	**1**	Semantic Analysis: Attribute grammars, syntax directed definition, evaluation and flow of attribute in a syntax tree. Symbol Table: Its structure, symbol attributes and management. Run-time environment:	**10**	**25%**

		Procedure activation, parameter passing, value return, memory allocation, and scope.		
IV	**1**	Intermediate Code Generation: Translation of different language features, different types of intermediate forms. Code Improvement (optimization): Analysis: control-flow, data-flow dependence etc.; Code improvement local optimization, global optimization, loop optimization, peep-hole optimization etc. Architecture dependent code improvement: instruction scheduling (for pipeline), loop optimization (for cache memory) etc. Register allocation and target code generation Advanced topics: Type systems, data abstraction, compilation of Object Oriented features and non-imperative programming languages.	**10**	**25%**
Total			**40**	**100**

Course code					
Category	**Core Course (CST)**				
Course title	**Computer Network**				
Scheme and Credits	**L**	**T**	**P**	**Credit**	**Semester VI**
	3	**-**	**2**	**4**	
Pre-requisites (if any)					
Course Objective	**The students will be able to** ● **To develop an understanding of modern network architectures from a design and performance perspective.** ● **To introduce the student to the major concepts involved in wide-area networks (WANs), local area networks (LANs) and Wireless LANs (WLANs).** ● **To provide an opportunity to do network programming** ● **To provide WLAN measurement ideas.**				
Course Outcomes	**At the end of this course students will demonstrate the ability to** ● **Explain the functions of the different layer of the OSI Protocol.** ● **Draw the functional block diagram of wide-area networks (WANs), local area networks (LANs) and Wireless LANs (WLANs) describe the function of each block.**				

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	• **For a given requirement (small scale) of wide-area networks (WANs), local area networks (LANs) and Wireless LANs (WLANs) design it based on the market available component** • **For a given problem related TCP/IP protocol developed the network programming.** • **Configure DNS DDNS, TELNET, EMAIL, File Transfer Protocol (FTP), WWW, HTTP, SNMP, Bluetooth, Firewalls using open source available software and tools.**

Module No.	**Sr. No**	**Topic and Details**	**No. of Hours assigned**	**Weightage in %**
I	**1**	**Data communication Components:** Representation of data and its flow Networks , Various Connection Topology, Protocols and Standards, OSI model, Transmission Media, LAN: Wired LAN, Wireless LANs, Connecting LAN and Virtual LAN, Techniques for Bandwidth utilization: Multiplexing - Frequency division, Time division and Wave division, Concepts on spread spectrum.	**10**	**25%**
II	**1**	**Data Link Layer and Medium Access Sub Layer:** Error Detection and Error Correction - Fundamentals, Block coding, Hamming Distance, CRC; Flow Control and Error control protocols - Stop and Wait, Go back – N ARQ, Selective Repeat ARQ, Sliding Window, Piggybacking, Random Access, Multiple access protocols -Pure ALOHA, Slotted ALOHA, CSMA/CD,CDMA/CA	**10**	**25%**
III	**1**	**Network Layer:** Switching, Logical addressing – IPV4, IPV6; Address mapping – ARP, RARP, BOOTP and DHCP–Delivery, Forwarding and Unicast Routing protocols. **Transport Layer:** Process to Process Communication, User Datagram Protocol (UDP), Transmission Control Protocol (TCP), SCTP Congestion Control; Quality of Service, QoS improving techniques: Leaky Bucket and Token Bucket algorithm.	**10**	**25%**
IV	**1**	**Application Layer:** Domain Name Space (DNS), DDNS, TELNET, EMAIL, File Transfer Protocol (FTP), WWW, HTTP, SNMP, Bluetooth, Firewalls, Basic concepts of Cryptography		
Total			**40**	**100**

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Suggested books

1. Data Communication and Networking, 4th Edition, Behrouz A. Forouzan, McGrawHill.

2. Data and Computer Communication, 8th Edition, William Stallings, Pearson Prentice Hall India.

Suggested reference books

1. Computer Networks, 8th Edition, Andrew S. Tanenbaum, Pearson New International Edition.

2. Internetworking with TCP/IP, Volume 1, 6th Edition Douglas Comer, Prentice Hall of India.

3. TCP/IP Illustrated, Volume 1, W. Richard Stevens, Addison-Wesley, United States of America.

<table>
<tr><td>Course code</td><td colspan="5"></td></tr>
<tr><td>Category</td><td colspan="5">Core Course (CST)</td></tr>
<tr><td>Course title</td><td colspan="5">Elective-II (Artificial Intelligence)</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credit</td><td rowspan="2">Semester VI</td></tr>
<tr><td>3</td><td>-</td><td>2</td><td>4</td></tr>
<tr><td>Pre-requisites (if any)</td><td colspan="5"></td></tr>
<tr><td>Course Objective</td><td colspan="5">The students will be able to
To give deep knowledge of AI and how AI can be applied in various fields to make the life easy
To know the difficulties that arises from attempting to define "Artificial Intelligence."
To know the areas of research of AI, and give examples of problems from each area.
To understand how advanced searches are performed.
Assess the applicability, strengths, and weaknesses of the basic knowledge representation, problem solving, and learning methods in solving particular engineering problems.
Provide you with the knowledge and expertise to become a proficient Robot Developer, data scientist.
Demonstrate an understanding of Artificial concepts that are vital for Robotics, Expert Systems, Machine Learning and data science;
Develop an interest in the field sufficient to take more advanced subjects.</td></tr>
</table>

	USHA MITTAL INSTITUTE OF TECHNOLOGY **SNDT Women's University** **Faculty : Technology (Undergraduate Course) -BTech**	

Course Outcomes	**At the end of this course students will demonstrate the ability to** ● **To understand various AI techniques.** ● **To decide when to use which type of AI technique.** ● **To correlate AI and solutions to modern problem.** ● **To decide when to use which type of AI technique.** ● **Develop intelligent systems by assembling solutions to concrete computational problems.** ● **Understand the role of knowledge representation, problem solving, and learning in intelligent-system engineering.** ● **Develop an interest in the field sufficient to take more advanced subjects like Machine Learning, Robotics, Data Science.**

Module No.	Sr. No	Topic and Details	No. of Hours assigned	Weightage in %
I	**1**	**Introduction to Artificial Intelligence**: what AI can do, Goals of AI, Methods of AI, what are AI technique, applications of AI in business, programming with and without AI, What is Intelligence, difference between Human and machine intelligence, Distributed AI and its applications. Predicate Logic, Knowledge Representation and its types. **AI Search algorithms**: Depth First Search, Breadth First Search, Bidirectional Search, Uniform cost search, iterative deepening DFS, A* search, greedy BFS, Hill Climbing, Local Beam, Traveling Salesman Problem, Problem Reduction and Game playing- Nim game using AND-OR and Min-Max strategies, alpha-beta pruning technique.	**10**	**25%**
II	**1**	**Planning:** Introduction, Types of planning systems operator-based, Case-based, Planning Algorithms, State-space Linear and non -linear, Block World Problem, Logic-based Planning , STRIPS-Style Operators, Linear planning using Goal stack method, Means-End Analysis. Non-linear Planning strategies-Goal set, Partial-Order planning, Constraint Posting method, Learning plans- Triangle Table.	**10**	**25%**
III	**1**	**Uncertainty Measure:** Introduction to uncertainty, Non-deterministic uncertainty, Joint and conditional probability, Bayes' Theorem using Hypothesis and Evidences, Chain Evidences, Probabilities in Rules and Facts of Rule-Based System, Cumulative Probability-OR-Combination, AND-Combination, Negative probabilities, Bayesian Belief Networks- definition, Inference using Bayesian Belief Networks, Examples, Advantages	**10**	**25%**

		and disadvantages of BBN. Inductive learning, Fuzzy sets and fuzzy logic, Certainty Factor Theory- Dempster-Shafer Theory, Natural Language Processing (NLP)- Overview of Linguistics, Components of NLP, Difficulties in NLU, NLP terminology, steps in NLP, Implementation aspects of Syntactic analysis: Context-Free-Grammar, Top-Down parser. AI based system to predict the diseases early		
IV	**1**	Research Areas of AI, Task classifications of AI, AI Issues, Difference in Robot system and other AI programs, Expert System Architecture, Evaluation of ES, Characteristic of ES, Capabilities of Expert System, Components of ES, Limitations of ES, Expert System Technology, Development of Expert system, Applications of ES, Benefits of ES, What is Robotics, difference in Robot and other AI program, Robot Locomotion, Components of a Robot, Computer Vision Tasks of computer vision, Robotic Processes Automation for supply chain management, Application domain of computer vision, AI/ML in Social Problems handling.	**10**	**25%**
Total			**40**	**100**

Suggested books :

1. Artificial Intelligence by Elaine Rich, Kevin Knight, Published by Tata McGraw-Hill Education Pvt. Ltd.
2. Artificial Intelligence: A Modern Approach by Russell and Norvig, A comprehensive reference for all the AI topics.

Suggested reference books:

1. Artificial Intelligence, by Saroj Kaushik, Cengage Learning, 2013.
2. Artificial Intelligence: foundations of computational agents by David Poole and Alan Mackworth, Cambridge University Press, 2010.
3. Tsang. Foundations of constraint satisfaction. Covers constraints satisfaction problems Available free online.
4. Paradigm of Artificial Intelligence Programming, by Peter Norvig.
5. Artificial Intelligence: A New Synthesis, by Nils J Nilsson.
6. Artificial Intelligence (3rd Edition), by Patrick Henry Winston.
7. Anindita Das Bhattacharjee, "Practical Workbook Artificial Intelligence and Soft Computing for beginners, Shroff Publisher-X team Publisher.
8. M.C. Trivedi, A Classical Approach to Artificial Intelligence, Khanna Publishing House, Delhi.
9. Sameer Dhanrajani, AI and Analytics, Accelerating Business Decisions, John Wiley & Sons.
10. Life 3.0: Being Human in the Age of Artificial Intelligence by Max Tegmark, published July 2018.

11. Homo Deus: A Brief History of Tomorrow by Yuval Noah Harari, published March 2017.
12. Artificial Intelligence in Practice: How 50 Successful Companies Used AI and Machine Learning to Solve Problems, Bernard Marr, Matt Ward, Wiley
13. Yuxi (Hayden) Liu, "Python Machine Learning by Example", Packet Publishing Limited, 2017.
14. Tom Mitchell, Machine Learning, McGraw Hill, 2017.

Corresponding Online Resources:

1. Artificial Intelligence, https://swayam.gov.in/nd2_cec20_cs10/preview.

Course code					
Category	**Core Course (CST)**				
Course title	**Elective -III (Neural network and deep learning)**				
Scheme and Credits	**L**	**T**	**P**	**Credit**	**Semester VI**
	3	**-**	**2**	**4**	
Pre-requisites (if any)					
Course Objective	**The students will be able to** • **To strengthen important Mathematical concepts required for Deep learning and neural network.** • **To get a detailed insight of advanced algorithms of ML.**				
Course Outcomes	**At the end of this course students will demonstrate the ability to** • **To design and implement Artificial Neural networks.** • **To decide when to use which type of NN.**				

Module No.	**Sr. No**	**Topic and Details**	**No. of Hours assigned**	**Weightage in %**
I	**1**	Biological Neuron models, Learning and Adaptation, Learning Rules. Neural Networks as a Paradigm for Parallel Processing, Information flow in a neural network, understanding basic structure and ANN. Classification Model, Features and Decision Regions, Linear Machine, Parametric and non parametric training concepts,	**10**	**25%**

		R-category discrete perceptron training algorithm, Single Layer feedback Networks, Unsupervised Neural Networks.		
II	**1**	Training a Neural network, how to determine hidden layers, recurrent neural network. Applications of Feedforward neural Networks.	**10**	**25%**
III	**1**	Convolutional neural networks, image classification and CNN. RNN and LSTMs. Applications of RNN in real world. Application of convolutional networks to visual detection and recognition tasks; Use of neural style transfer to generate art and apply these algorithms to a variety of image, video,	**10**	**25%**
IV	**1**	Creating and deploying networks using tensor flow and keras., TensorFlow 2.x and Keras to build, train, and deploy machine learning models. Improving the accuracy of Learning models.	**10**	**25%**
Total			**40**	**100**

Suggested books /Suggested reference books:

1. Rajiv Chopra, Deep Learning, Khanna Publishing House.

2. John Paul Mueller, Luca Massaron, Deep Learning for Dummies, John Wiley & Sons. 3. Adam Gibson, Josh Patterson, Deep Learning, A Practitioner's Approach, Shroff Publisher /O'Reilly Publisher Media. 4. Christopher M. Bishop, Neural Networks for Pattern Recognition, Oxford.9 5. Russell Reed, Robert J MarksII, Neural Smithing: Supervised Learning in Feedforward Artificial Neural Networks, Bradford Book Publishers.

Corresponding Online Resources: 1. Fuzzy Logic and Neural Networks, https://swayam.gov.in/nd1_noc20_ge09/preview.

	USHA MITTAL INSTITUTE OF TECHNOLOGY **SNDT Women's University** **Faculty : Technology (Undergraduate Course) -BTech**	

Course code					
Category	**Core Course (CST)**				
Course title	**Object oriented modelling and design**				
Scheme and Credits	**L**	**T**	**P**	**Credit**	**Semester VI**
	3	**-**	**2**	**4**	
Pre-requisites (if any)					
Course Objective	**The students will be able to** ● **Different models to represent the analysis and design of project.**				
Course Outcomes	**At the end of this course students will demonstrate the ability to** ●				

Module No.	**Sr. No**	**Topic and Details**	**No. of Hours assigned**	**Weightage in %**
I	**1**	**Introduction :** Object oriented approach, Object oriented themes, and Object oriented methodologies, three models. **Object modeling:** Objects and classes, Links and association, multiplicity, Advanced link and association concepts, Generalization and inheritance, Grouping constructs, problems on object modeling. **Advanced Object Modeling:** Aggregation, Abstract classes, Generalization as an extension and restriction, Multiple inheritance, Metadata, Candidate key, Constraints, Homomorphism, problems using concepts of Advanced Object Modeling.	**10**	**25%**
II	**1**	**Dynamic modeling:** Events and states, scenarios and event trace diagrams, state diagrams, operations, Nested state diagrams, concurrency, Advanced Dynamic Modeling concepts, Relation of	**10**	**25%**

		object and dynamic models, problems on dynamic modeling or state diagrams. **Functional Modeling:** Functional models, Data Flow Diagrams, Specifying Operations, Relation of functional to object and dynamic models, Problems on functional modeling.		
III	**1**	**Analysis:** Overview of analysis, Problem statement, steps to design object model, Steps to construct dynamic model, steps to build functional model. Adding operations, iterating the analysis, Problems. **System Design:** Overview of system design, Breaking a system into subsystem, Identifying concurrency, Allocating subsystems to processors and tasks, Management of data stores, Handling global resources, Choosing software control implementation, Handling boundary conditions, Setting trade-off priorities, Common Architectural Frameworks. **Object Design:** Overview of object design, Combining the three models, Designing algorithms, Design optimization, Implementation of control, Adjustment of Inheritance, Physical packaging, problems.	**10**	**25%**
IV	**1**	**Comparison of methodology:** Structured analysis/Structured design, approach of SA/SD, Comparison with OMT, Jackson structured development (JSD) approach, comparison with OMT. **From design to implementation:** Implementation using a programming language, database system, outside a computer. Programming Style: Object oriented style, reusability, extensibility, robustness, programming in large. **UML CONCEPTS** Goals of UML, UML views, Use case View, Interaction view, Collaboration diagram, Sequence diagram, State machine view, Activity view, Activity diagram, Physical view, Model management view.	**10**	**25%**
Total			**40**	**100**

Suggested books :

James Rumbaugh, "Object oriented Modeling and Design", PHI Publication, 2001. (Rs.175).

Suggested reference books:

1. Grady Booch, "Object Oriented Analysis and Design",Second Edition, Addison Wesley Publication, 1994. (Rs.439/-)
2. Peter Coad, Edward Yourdon "Object Oriented Analysis", Second Edition, Pearson Education publication, 2001. (Rs.275/-)
3. Andrew T.F. Hutt "Object Analysis and Design, Description of methods", Second Edition, A Wiley QED Publication, 1994. (Rs.1264/-)
4. Andrew T.F. Hutt "Object Analysis and Design, comparison of methods", Second Edition, A Wiley QED Publication, 1994. (Rs.1264/-)
5. Rebeca Brokes, **"**Designing object oriented software", Second Edition, PHI, 1997 (Rs.125/-)

USHA MITTAL INSTITUTE OF TECHNOLOGY

(umit.ac.in)

SNDT Women's University

(Sndt.digitaluniversity.ac)

Syllabus B. Tech.
CST Syllabus

SNDT Women's University

1, Nathibai Thackersey Road,
Mumbai 400 020

(Applicable to students taking admission in and after 2019)

	USHA MITTAL INSTITUTE OF TECHNOLOGY **SNDT Women's University** **Faculty: Technology (Undergraduate Course) -BTech**	

Credit Definition

1 Hr. Lecture (L) per week	1 credit
1 Hr. Tutorial (T) per week	1 credit
1 Hr. Practical (P) per week	0.5 credits
2 Hours Practical(Lab)/week	1 credit

Course code and Definition:

Course Code	Definitions
L	Lecture
T	Tutorial
P	Practical
D	Duration of Paper
TP	Term Paper
TW	Term Work
P/V	Practical/Viva
BSC	Basic Science Courses
ESC	Engineering Science Courses
HSMC	Humanities and Social Sciences including Management courses
PCC	Professional core courses
PEC	Professional Elective courses
OEC	Open Elective courses
LC	Laboratory course
MC	Mandatory courses
PROJ	Project

USHA MITTAL INSTITUTE OF TECHNOLOGY
SNDT Women's University
Faculty: Technology (Undergraduate Course) -BTech

SCHEME: Semester VII

Category and Code	Course title	Hours per Week			Cr	D	TP	TW	P/V	Total
		L	T	P						
Professional Elective courses PEC	Elective-IV (Cryptography and Network Security)	3	0	-	3	2.5	75	25		100
Professional Elective courses PEC	Elective-V (Cloud Computing)	3	0	-	3	2.5	75	25		100
Professional Elective courses PEC	Elective-VI (Computational Data analytics)	3	0	0	3	2.5	75	25		100
Professional Core Courses PCC	Game Theory	3	0	0	3	2.5	75	25		100
Humanities & Social Sciences including Management courses	Humanities II (Technical Communication and Professional Ethics)	3	0	0	3	2.5	75	25		100
Project	Project-II	0	0	8	4	-	-	100		100
	Elective-IV (Cryptography and Network Security) Lab			2	1	-			25	25
	Elective-V (Cloud Computing) Lab			2	1	-			25	25
	Elective-VI (Data analytics Lab)			2	1	-			25	25
	Total	15	0	14	22					675

	USHA MITTAL INSTITUTE OF TECHNOLOGY **SNDT Women's University** **Faculty: Technology (Undergraduate Course) -BTech**	

SCHEME: Semester VIII

Category and Code	**Course title**	**Hours per Week**			**Cr**	**D**	**TP**	**TW**	**P/ V**	**Total**
		L	**T**	**P**						
	Internship	-	-	-	4	0	0	50	50	100
Open Elective courses OEC	Open Elective-IV (Cyber law and Ethics)	-	-	-	0	0	0	25	25	50
Project	Project-III	-	-	32	16	-	-	200	200	400
				-	-	-		-		
	Total	0	0	32	20					550

- Under Internship, the Student should pursue an internship program of minimum 4 weeks with a company ,expected contact hours in industry 160 to 180hrs.
- The students undergoing such a program include compulsory industrial training of 4 credits, by the end of the eighth semester.
- Internships can be in offline or online mode.
- Every student is required to prepare a file containing documentary proofs of the activities done by her in an industry.
- Weekly progress report should be mailed to faculty mentor and industry supervisor.
- The student will have to submit the internship joining letter, daily attendance record , a detailed report and presentation and completion certificate from industry
- Students should maintain handwritten internship dairy(include daily attendance and daily progress report) signed by industry supervisor.
- Students undergo industrial training at the concerned Industry / Organization. In-between Faculty Member(s) evaluate(s) the performance of students once/twice

and Evaluation Report of the students is submitted in the department with the consent of Industry persons/Trainers.

- Internship can be extended for **PROJECT III** with permission from the institute.
- Internship evaluation and Project III evaluation are separate .
- Non-credit subject Passing Mandatory. A total of 16 contact hours needs to be completed.
- Non Credit course, Report of outcome based case studies will be evaluated as continuous assessment

Elective I	**Elective II**	**Elective III**	**Elective IV**	**Elective V**	**Elective VI**
Software Engineering	Artificial Intelligent	IOT	Cryptographic and network Security	Cloud Computing	Computational Data analytics
Neural Networks and Deep Learning	Data Mining	Soft computing	Human computer interaction	Parallel and distributed algorithm	Ad -Hoc sensor Network
Multi-agent Intelligent	Information Retrieval	Multi-agent Intelligent	Quantum computing		-

Open Elective-I	**Open Elective-II**	**Open Elective-III**	**Open Elective-IV**
Object oriented modeling and design	Technical Communication and Professional Ethics	History of Science and Engineering	Cyber law and Ethics
Introduction to Philosophical Thoughts	Human Resource Development and Organizational Behavior	Comparative Study of Literature	Economic Policies in India

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SCHEME: Semester VII

Elective-IV Cryptography and Network Security			
Branch : CST	**Sem: VII**	**Lectures: 3 Hr**	**Credit: 3**
Objective : ● Students will learn the need of security in the field of information systems which includes hardware, software, data and network. They also understand the threat to the system and what all countermeasures and protocols that can be applied to secure the computer resources.			

Module no	**Sr No**	**Topic and Details**	**No. of Lectures assigned**	**Weightage in %**
I	1	**Introduction**: Security, Attacks, Computer criminals, Method of defense **Cryptography:** Basic Cryptography: Classical Cryptosystems, Public key Cryptography and Cryptographic checksum, Key Management: Key exchange, Key generation, Cryptographic key infrastructure, Storing and revoking keys, Hash algorithm, Digital signature, Cipher Techniques Problems, Stream and block ciphers: AES, DES and RC4.	10	25
II	2	**Program Security:** Secure programs, Non-malicious program errors, Viruses and other malicious code, Targeted malicious code, Controls against program threats . **Operating System Security**: Protected objects and methods of protection, Memory address protection, Control of access to general objects, File protection mechanism, Authentication:Authentication basics, Password, Challenge-response, Biometrics	10	25

III	**3**	**Security in Networks**: Threats in networks, Network security control, Firewalls, Intrusion detection systems, Secure email, Networks and cryptography, Example **protocols:** PEM, SSL, Ipsec.	10	25
IV	**4**	**Cyber Security, Legal, Privacy, and Ethical Issues in Computer Security:** Protecting programs and data, Information and law, Rights of employees and employers, Software failures, Computer crime,Privacy, Ethical issues in computer society Case studies of ethics.	10	25
		Total	40	100

Text Books:

1. Stallings, "Cryptography And Network Security: Principles and practice".
2. P. Pfleeger and S. L. Pfleeger, "Security in Computing", Pearson Education.
3. Matt Bishop, "Computer Security : Art and Science", Pearson Education

Reference Books:

- Kaufman, Perlman, Speciner, "Network Security"
- Eric Maiwald, "Network Security: A Beginner's Guide", TMH
- Bruce Schneier, "Applied Cryptograph"', John Wiley.
- Whitman, Mattord, "Principles of information security", Thomson

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CLOUD COMPUTING			
Branch : CST	**Sem: VII**	**Lectures: 3hrs**	**Credit: 3**
Objective: ● **Identify key elements of the cloud computing** ● **Understand and appreciate the need for cloud computing, and identify their use in industrial applications** ● **Analyze the current issues in cloud computing**			

Module	**Sr no**	**Topic and Details**	**No of lectures assigned**	**Weightage in %**
I	1	**Introduction to cloud computing:** Introduction :Components of CC,Comparing CC Cloud Computing with Virtualization, Grids, Utility Computing, client-server model, P-to-P Computing ,Impact of CC on Business ,Key Drivers for Cloud Computing, Cloud computing Service delivery model **Cloud Types : Private, Public and Hybrid, when to avoid public cloud, Cloud API**	10	25
	2	**Virtualization:** Introduction & benefit of Virtualization, Implementation Levels of Virtualization-VMM Design Requirements and Providers:Virtualization at OS level ,Middleware support for Virtualization Virtualization structure/tools and mechanisms: Hypervisor and Xen Architecture, Binary Translation with full Virtualization, Para Virtualization with Compiler Support Virtualization of CPU, Memory and I/O Devices, Hardware support for Virtualization in intel x86 processor,CPU Virtualization, Memory Virtualization and I/O Virtualization ,Virtualization in Multicore processors		
II	3	**Cloud computing Services**: XaaS, IaaS, PaaS,Leveraging PaaS for Productivity, Services Languages for PaaS, DBaaS(Database as a services) , SaaS	10	25

		(Software as a service) , Comparison of various cloud computing providers/ Softwares.		
	4	**Open Source Cloud Implementation and Administration**: Open Stack Architecture Features , Components, Various mode of operations, installation and configuration ,Cloud Administration and Management Task , Creating UserInterface (Web Interface) of Private cloud		
III	5	**Cloud Deployment:** Factors for Successful Cloud Deployment ,Network Techniques Requirements, Potential Problem areas in a cloud Network and their Mitigation, Cloud Network Topologies , Automation and Self service feature in a cloud ,cloud performance	10	25
	6	**Security:** Security for Virtualization Platform:Host security for SaaS,PaaS and IaaS. Data Security: Data Security Concerns ,Data Confidentiality and Encryption ,Data Availability ,Data Integrity ,Cloud Storage Gateways ,Cloud Firewall.		
IV	7	**Architecture for Cloud Application:** Cloud Application requirements, Architecture for traditional Cloud Application Vs Cloud Applications, Multi-tier Application Architecture. SOA for Cloud applications : Resource oriented SOA , Method , oriented SOA and Event Driven SOA Parallelization within Cloud Applications, Leveraging In-memory Operations for Cloud Application	10	25
	8	**Adoption and Use of Cloud:** Adoption of Public cloud by SMBs,Public Cloud AdoptionCloud phase for SMBs, Vendor liability and Management. Adoption process of Public clouds by Enterprises ,Managed Private clouds. Migrating Application to the cloud: Impact of Shared Resources and Multi-Tenancy on cloud Applications , Phases during Migration an Application to An IaaS Cloud Cloud Programming: Programming Support for Google Apps engine: GFS, BigTables, Googles NO SQL System, Chubby, Google Distributed Lock Service, Programming Support for Amazon EC2: Amazon S3, EBS and Simple DB etc		
TOTAL			40	100

Text Book:

1. Rajkumar Buyya, Cloud computing principles and Paradigms, Wiley.
2. Kai Hwang, "Distributed and Cloud Computing",Mk Publication.
3. Kailash Jayaswal, Deven Shah "Cloud Computing Black Book" ,Dreamtech Publication.

Reference Book:

1. Scott Granneman, "Google Apps" ,Pearson.
2. Tim Malhar, S.Kumaraswamy, S.Latif, "Cloud Security & Privacy" (SPD,O'REILLY).
3. Anthony T Velte, "Cloud Computing : A Practical Approach", McGraw Hill.. Barrie Sosinsky ,"Cloud Computing Bible ", Wiley India.

COMPUTATIONAL DATA ANALYTICS			
Branch : CST	**Sem: VII**	**Lectures: 3hrs**	**Credit: 3**
Objective: ● Gather sufficient relevant data, conduct data analytics using scientific methods, and make appropriate and powerful connections between quantitative analysis and real-world problems.			

- Use advanced techniques to conduct thorough and insightful analysis, and interpret the results correctly with detailed and useful information.

Module No.	**Sr. No**	**Topic and Details**	**No. of Hours assigned**	**Weightage in %**
I	**1**	Introduction to R Computing language. Best practices in executing Reproducible Research in data science, Sampling and Simulation. Descriptive statistics, and the creation of good observational sampling designs.	**10**	**25%**
II	**2**	Data visualization, Data import and visualization, Introduction to various plots Frequentist Hypothesis Testing, Z-Tests, Power Analysis	**10**	**25%**
III	**3**	Linear regression, diagnostics, visualization, Likelihoodist Inference, Fitting a line with Likelihood, Model Selection with one predictor	**10**	**25%**
IV	**4**	Bayesian Inference, Fitting a line with Bayesian techniques, Multiple Regression and Interaction Effects, Information Theoretic Approaches	**10**	**25%**

Text/References:

Text Books/References:
1. Beginner's Guide for Data Analysis using R Programming, Khanna Publishing House
2. Practical Data Science with R, Nina Zumel, John Wiley & Sons.
3. Big Data & Hadoop, V.K. Jain, Khanna Publishing House.
4. N. C. Das, Experimental Designs in Data Science with Least Resources, Shroff Publisher Publisher.

5. Hadley Wickham, Garret Grolemund, R for Data Science, Shroff Publisher/O'Reilly Publisher Publisher
6. Benjamin M. Bolker. Ecological Models and Data in R. Princeton University Press, 2008. ISBN 978-0-691-12522-0.
7. John Fox and Sanford Weisberg. An R Companion to Applied Regression. Sage Publications, Thousand Oaks, CA, USA, second edition, 2011. ISBN 978-1-4129-7514-

Elective-IV Game Theory			
Branch : CST	**Sem: VII**	**Lectures: 3 Hr**	**Credit: 3**

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Objective :

- The course seeks to reinforce basic concepts in microeconomics and apply them to the world of business, strategy and decision making. The course is applied in nature, and bases itself extensively on case studies, real world problems and project work from both the corporate world as well as academia.

Module no	Sr No	Topic and Details	No. of Lectures assigned	Weightage in %
I	1	**Introduction To Game Theory:** An overview of microeconomic models relevant to game theory - an introduction to the motivation for game theory - revisiting the prisoner's dilemma - the 2x2 form standard model - dominance - Nash equilibrium - SPNE.	10	25
II	2	Zero sum games - general sum games - the coordination problem - cooperative games - non-cooperative games - decision making and uncertainty - reciprocate decision making - case studies	10	25
III	3	Voting theory - voting strategies - auctions - types of auctions - auction design - elicitation - scoring rules - adaptive decision making	10	25
IV	4	Case studies: pricing, marketing, strategy, HR, finance, taxation, dominant assurance contracts, compliance, incentive design.	10	25
		Total	40	100

Text Books:

- The Art of Strategy, by Avinash Dixit and Barry J. Nalebuff .
- Games of Strategy, by Avinash Dixit
- Game Theory 101: The Complete Textbook by William Spaniel
- Introducing Game Theory: A Graphic Guide by Ivan Pastine, Tuvana Pastine and Tom Humberstone

Humanities II (Technical Communication and Professional Ethics)			
Branch : CST	**Sem: VII**	**Lectures: 3hrs**	**Credit: 3**

Objective: The learners will be able to

- identify and select many types of writing frequently required in a variety of careers,
- practice audience analysis and develop effective communication strategies for a variety of audiences.
- determine your purposes/objectives and develop skill in composing and revising on the computer documents with formats and language appropriate for those purposes,
- demonstrate in your writing the effective communication principles encouraged by professional writers,
- achieve a greater awareness of the importance of selecting and integrating graphics with written communication,to differentiate among and to use facts, inferences and judgments.

Module No.	**Sr. No**	**Topic and Details**	**No. of Hours assigned**	**Weightage in %**

I	**1**	Technical Communication: features: Distinction between General and Technical communication; Language as a tool of communication; Levels of communication: Interpersonal, Organizational, Mass communications; definition, types barriers of Communication, The flow of Communication: Downward, Upward, Lateral of Horizontal (Peer group): Importance of technical communication; Barriers to Communication.	10	25
II	**2**	Technical writing process, forms of discourse, writing drafts and revising, collaborative writing, creating indexes, technical writing style, and language. Research paper writing (*conference* and journals). Basics of grammar, the study of advanced grammar, editing strategies to achieve appropriate technical style. Introduction to advanced technical communication, usability, human factors, managing technical projects, time estimation, single sourcing, localization. Public speaking, group discussion, oral, presentation, interviews, graphic presentation, presentation aids, personality development, writing reports, project proposals, brochures, newsletters, technical articles, manuals, office notes, business letters, memos, progress reports, minutes of meetings, event reports.	10	25
	3	Self-Development and Assessment- Leadership, assertiveness, Self-assessment, Awareness, Perception and Attitudes, Values and Beliefs, Personal goal setting, career planning, Self-esteem. Managing Time; Personal memory, Rapid reading, taking notes; Complex problem solving; Creativity		
III	**4**	Intellectual property Rights- Concept of Property Kinds of Property, Philosophy of IPR: History and Evolution of IPR, Changing dimensions of IPR, IP as a tool for Economic Development Block Kinds of IPR, Copyright and Related Rights, Creative Commons, Creative Commons License, Plagiarism, Importance od IPR for Engineers.	10	25

IV	**5**	Ethics- Business ethics, Etiquette in social and office settings, Email etiquette, Telephone Etiquettes, engineering ethics, Managing time, Role and responsibility of engineer, Work culture in jobs, Personal memory.	10	25
		Total	40	100

Suggested Text / Reference Books

1. David F. Beer and David McMurrey, Guide to writing as an Engineer, John Willey. New York, 2004

2. Diane Hacker, Pocket Style Manual, Bedford Publication, New York, 2003. (ISBN 0312406843)

3. Shiv Khera, You Can Win, Macmillan Books, New York, 2003.

4. Raman Sharma, Technical Communications, Oxford Publication, London, 2004.

5. Dale Jungk, Applied Writing for Technicians, McGraw Hill, New York, 2004. (ISBN: 07828357-4)

6. Sharma, R. and Mohan, K. Business Correspondence and Report Writing, TMH New Delhi 2002.

7. Xebec, Presentation Book, TMH New Delhi, 2000. (ISBN 0402213)

8. The Elements of Style Book by William Strunk Jr.

Semester VIII

Open Elective IV **Cyber law and Ethics**			
Branch : CST	**Sem: VIII**	**Lectures: 3hrs**	**Credit: 3**

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Objective: The learners will be able to

- Understand Cyber laws
- Describe Information Technology act and Related Legislation.
- Demonstrate Electronic business and legal issues.
- Interpret Cyber Ethics.

Module No.	Sr. No	Topic and Details	No. of Hours assigned	Weightage in %
I	1	**Introduction to Cyber law:** Evolution of computer Technology, emergence of cyberspace. Cyber Jurisprudence, Jurisprudence and law, Doctrinal approach, Consensual approach, Real Approach, Cyber Ethics, Cyber Jurisdiction, Hierarchy of courts, Civil and criminal jurisdictions, Cyberspace Web space, Web hosting and web Development agreement, Legal and Technological Significance of domain Names, Internet as a tool for global access.	10	25
II	2	**Information Technology Act:** Overview of IT Act, 2000, Amendments and Limitations of IT Act, Digital Signatures, Cryptographic Algorithm, Public Cryptography, Private Cryptography, Electronic Governance, Legal Recognition of Electronic Records, Legal Recognition of Digital Signature, Certifying Authorities, Cyber Crime and Offenses, Network Service Providers Liability, Cyber Regulations Appellate Tribunal, Penalties and Adjudication.	10	25

III	**3**	**Cyber law and Related Legislation:** Patent Law, Trademark Law, Copyright, Software – Copyright or Patented, Domain Names and Copyright disputes, Electronic DataBase 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).	10	25
IV	**4**	**Electronic Business and legal issues:** Evolution and development in E-commerce, paper vs paperless contracts E-Commerce models- B2B, B2C, E security. Business, taxation, electronic payments, supply chain, EDI, E-markets, Emerging Trends.	10	25
	5	**Cyber Ethics:** The Importance of Cyber Law, Significance of Cyber Ethics, Need for Cyber regulations and Ethics. Ethics in Information society, Introduction to Artificial Intelligence Ethics: Ethical Issues in AI and core Principles, Introduction to Block chain Ethics.		
		Total	40	100

Suggested Text / Reference Books

1. Cyber Laws: Intellectual property & E Commerce, Security- Kumar K, dominant Publisher 2. Cyber Ethics 4.0, Christoph Stuckelberger, Pavan Duggal, by Globethic
2. Information Security policy & Implementation Issues, NIIT, PHI .
3. Computers, Internet and New Technology Laws, Karnika Seth, Lexis Nexis Butterworths Wadhwa Nagpur.
4. Legal Dimensions of Cyber Space, Verma S, K, Mittal Raman,

Indian Law Institute, New Delhi, 6. Cyber Law, Jonthan Rosenoer, Springer, New York, (1997).

5. The Information Technology Act, 2005: A Handbook, OUP Sudhir Naib,, New York, (2011) 8. Information Technology Act, 2000, S. R. Bhansali,, University Book House Pvt. Ltd., Jaipur (2003). 9. Cyber Crimes and Law Enforcement, Vasu Deva, Commonwealth Publishers, New Delhi, (2003).