SYLLABUS

FOR

FIRST YEAR

B.TECH PROGRAMMES

(Effective from 2023-24)

MBA PROGRAMME

INTEGRATED MBA PROGRAMME

MCA PROGRAMME

(Effective from 2024-25)

2024-25

BIJU PATNAIK UNIVERSITY OF TECHNOLOGY, ODISHA

ROURKELA

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SYLLABUS

FOR

FIRST YEAR

B.TECH PROGRAMME

(Effective from 2023-24)

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BIJU PATNAIK UNIVERSITY OF TECHNOLOGY, ODISHA

ROURKELA

COURSE STRUCTURE

COMMON TO ALL BRANCHES

FIRST SEMESTER

Category	Subject Code	Subject	L-T-P	Credit	University Marks	Internal Marks
THEORY						
1. BS	23BS1001	Mathematics - I	3-0-0	3	100	50
2. BS	23BS1002	Physics /	3-0-0	3	100	50
BS	23BS1003	Chemistry				
3. ES	23ES1001	Basic Electrical Engineering /	2-0-0	2	100	50
ES	23ES1002	Basic Electronics				
4. ES	23ES1003	Programming in C and Data Structure /	3-0-0	3	100	50
ES	23ES1004	Engineering Mechanics				
5. ES	23ES1005	Basic Civil Engineering /	2-0-0	2	100	50
ES	23ES1006	Basic Mechanical Engineering				
6. HS	23HS1001	Universal Human Values /	2-0-0	2	100	50
HS	23HS1002	English for Technical Writing				
	Total		**15-0-0**	**15**	**600**	**300**
SESSIONAL / PRACTICAL						
7. BS	23BS1201	Physics Lab. /	0-0-3	1.5	-	100
BS	23BS1202	Chemistry Lab.				
8. ES	23ES1201	Basic Electrical Engineering Lab./	0-0-3	1.5	-	100
ES	23ES1202	Basic Electronics Lab.				
9. ES	23ES1203	Programming Lab. /	0-0-3	1.5	-	100
ES	23ES1204	Communicative English & Report Writing Lab.				
10. ES	23ES1205	Engineering Graphics & Design Lab. /	0-0-3	1.5	-	100
ES	23ES1206	Workshop & Digital Manufacturing Lab.				
11. MC	23MC1201	Sports / Yoga / NCC / NSS	0-0-2	1	-	100
		Total	**15-0-14**	**07**	**-**	**500**
		Total Semester		**22**	**600**	**800**
		Grand Total (Theory + Practical) = 1400				

SECOND SEMESTER

Category	Subject Code	Subject	L-T-P	Credit	University Marks	Internal Marks
THEORY						
1. BS	23BS1004	Mathematics - II	3-0-0	3	100	50
2. BS	23BS1003	Chemistry /	3-0-0	3	100	50
BS	23BS1002	Physics				
3. ES	23ES1002	Basic Electronics /	2-0-0	2	100	50
ES	23ES1001	Basic Electrical Engineering				
4. ES	23ES1004	Engineering Mechanics /	3-0-0	3	100	50
ES	23ES1003	Programming in C and Data Structure				
5. ES	23ES1006	Basic Mechanical Engineering /	2-0-0	2	100	50
ES	23ES1005	Basic Civil Engineering				
6. HS	23HS1002	English for Technical Writing /	2-0-0	2	100	50
HS	23HS1001	Universal Human Values				
	Total		**15-0-0**	**15**	**600**	**300**
SESSIONAL / PRACTICAL						
7. BS	23BS1202	Chemistry Lab. /	0-0-3	1.5	-	100
BS	23BS1201	Physics Lab.				
8. ES	23ES1202	Basic Electronics Lab./	0-0-3	1.5	-	100
ES	23ES1201	Basic Electrical Engineering Lab.				
9. ES	23ES1204	Communicative English & Report Writing Lab. /	0-0-3	1.5	-	100
ES	23ES1203	Programming Lab.				
10. ES	23ES1206	Workshop & Digital Manufacturing Lab. /	0-0-3	1.5	-	100
ES	23ES1205	Engineering Graphics & Design Lab.				
11. MC	23MC1202	Sports / Yoga / NCC / NSS	0-0-2	1	-	100
		Total	**15-0-14**	**07**	**-**	**500**
		Total Semester		**22**	**600**	**800**
		Grand Total (Theory + Practical) = 1400				

23BS1001 MATHEMATICS - I (3-0-0)

Course Objective : The goal of this course is to achieve conceptual understanding and to retain the best traditions of traditional calculus. The syllabus is designed to provide the basic tools of calculus mainly for the purpose of modeling the engineering problems mathematically and obtaining solutions. This is a foundation course which mainly deals with topics such as single variable and multivariable calculus and plays an important role in the understanding of science, engineering and also other disciplines.

Module - I (08 hrs)
Basic Calculus: Applications of definite integrals to evaluate length of curves, areas of surfaces and volumes of surfaces of revolution, Improper integral (Definition and Elementary Examples),Beta and Gamma functions and their properties.

Module - II (08 hrs)
Single-variable Calculus (Differentiation): Rolle's Theorem, Mean value theorem (Statement and applications), First derivative test for local extreme values of functions. Power series, Taylor and Maclaurin series.

Module - III (08 hrs)
Multivariable Calculus (Differentiation): Partial derivatives. Jacobians, Hessian Matrix. Maxima, Minima and saddle points. Method of Lagrange multipliers.

Module - IV (08 hrs)
Linear Algebra: Vector Space, Basis and dimension, Linear Systems of Equations, Gauss elimination, Linear Dependence and Independence, Rank of a Matrix.

Module - V (08 hrs)
Linear Algebra:Inverse of a matrix (Gauss-Jordan). Symmetric, skew-symmetric and orthogonal matrices. Eigen values and eigenvectors. CaleyHamilton Theorem (Statement only)

Essential Reading:

1. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition, Pearson, 2002.
2. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.

Supplementary Reading:

1. Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint, 2010.
2. Gilbert Strang, Introduction to Linear Algebra, 5th Edition, 2016.
3. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008.

Course Outcomes:
CO1: To apply differential and integral 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.

CO2: The fallouts of Rolle's Theorem that is fundamental to application of analysis to Engineering problems.
CO3: The tool of power series for learning advanced Engineering Mathematics.
CO4: To deal with functions of several variables that are essential in most branches of engineering.
CO5: Learn how to convert a real life problem into a matrix system and solve it.

23BS1002 PHYSICS (3-0-0)

Course Objective: To enhance the fundamental knowledge in Physics and its applications relevant to various streams of Engineering and Technology.

Module I (09 Hrs)
OSCILLATIONS : Mechanical and electrical simple harmonic oscillators, damped harmonic oscillator – heavy, critical and light damping, energy decay in a damped harmonic oscillator, quality factor, forced mechanical and electrical oscillators, steady state motion of forced damped harmonic oscillator

Module II (09 Hrs)
WAVES AND OPTICS : Concept of wave and Wave equation, Superposition of many harmonic waves, Concept of coherent sources (Division of wave front and division of amplitude), Interference in thin parallel film, Newton's ring: Determination of wavelength of light, Refractive index of liquid).Concept of diffraction (Huygen's Principle), Types of diffraction, Franhoffer diffraction due to single slit, diffraction grating (qualitatively).

Module III (09 Hrs)
ELCTROMAGNETISM : Vector calculus: Gradient, Divergence, Curl (Mathematical concept), Gauss divergence theorem and Stoke's theorem(statement only), Derivation of Maxwell's electromagnetic equation in differential form and integral form, Electromagnetic wave equations for E and B in vacuum and conducting medium, transverse nature of EM waves.

Module IV (09 Hrs)
QUANTUM PHYSICS : Wave particle duality, concept of phase velocity group velocity, relation between them, Matter waves (de Broglie hypothesis), Wave functions, Observables as operators, Eigen function and Eigen values, Normalization, Expectation values, Schrodinger equation (Time dependent and time independent), Particle in a box.

Module V (08 Hrs)
LASERS : Introduction to Laser, Characteristics of Lasers, Einstein's coefficients and relation between them, Lasing action, Population inversion, Three and four level pumping schemes, Ruby Laser, He-Ne Laser.

Essential / Supplementary Readings:

1. Ian G. Main, Oscillations and waves in physics, Cambridge University Press
2. H.J. Pain, The physics of vibrations and waves, John Wiley & Sons Ltd.
3. E. Hecht, Optics, Pearson Education Ltd.
4. A. Ghatak, Optics, McGraw Hill Publisher
5. O. Svelto, Principles of Lasers, Springer

Course Outcome: At the end of this course students will demonstrate the ability to

CO1: Demonstrate proficiency and perceptive of the basic concepts in physics.

CO2: Utilize the scientific and experimental methods to investigate and verify the concepts related to content knowledge.

CO3: Exploring the engineering applications and apply quantum mechanics to engineering Phenomena.

CO4: Identifying the relevant formulae and work out engineering problems.

CO5: Comprehend principle, concept, working and application of new technology and comparison of results with theoretical calculations.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	2	2	1	1	1	1	1	2	1
CO2	3	3	3	2	1	2	1	1	1	1	1	2
CO3	3	3	3	3	1	1	2	1	1	1	1	2
CO4	3	3	3	2	1	1	1	2	1	1	2	2
CO5	3	3	2	3	2	1	1	2	2	2	1	2

23BS1003 CHEMISTRY (3-0-0)

Module–I: (9Hours)

PERIODIC PROPERTIES : Periodic Properties, Effective Nuclear Charge, Penetration of Orbitals, Variations of s, p, d and f Orbital Energies of Atoms in the Periodic Table, Electronic Configurations, Atomic andIonic Sizes, Ionization Energies, Electron Affinity and Electronegativity, Polarizability, Oxidation States.

Module–II: (9 Hours)

FREE ENERGY IN CHEMICAL EQUILIBRIA : Concepts of Entropy, Entropy in Physical and Chemical Changes, Free Energy Concepts, Gibbs Helmholtz Equation, Free Energy Change and Criterion of Spontaneity of Chemical Equation and Chemical Equilibrium, Van't Hoff Equation.

Module–III: (9 Hours)

SPECTROSCOPIC TECHNIQUES AND APPLICATIONS : Basic Terms and Principles of Spectroscopy Molecular Rotational (Microwave) Spectroscopy: Basic Principle and Application toDiatomic Molecules, Selection Rules.

Molecular Vibrational (IR) Spectroscopy: Basic Principle, Types of Vibrations , VibrationalFrequency, Selection Rules.

Electronic (UV-Visible) Spectroscopy: Laws of Absorption, Basis Principle, Types ofElectronic Transitions, Chromophores and Auxochrome.

Module–IV: (9 Hours)

STEREOCHEMISTRY : Structural and Stereoisomer (Geometrical and Optical), Symmetry and Chirality, Enantiomers, Diastereomers, Optical Activity, Configurational and Conformational Analysis,Representations of Three Dimensional Structures (E, Z and R,S only).

Module–V: (9 Hours)

ORGANIC REACTIONS AND SYNTHESIS : Introduction to Reaction Intermediates {Carbocation, Carbanion, Free Radial (Formation, structure and stability)}, Reactions involving Substitution, Addition, Elimination (Examples and Mechanisms).

Essential Reading:

1. Engineering Chemistry: fundamental to Applications by Shikha Agarwal, CambridgeUniversity Press, Second Edition, 2019.
2. Engineering Chemistry by B. Rama Devi, P. Aparna, and PrasantaRath, CengageLearning, First Edition, 2023.

Supplementary Reading:

1. Atkins' Physical Chemistry by Peter Atkins, Julio de Paula, and James Keeler, OxfordUniversity Press, Eleventh Edition, 2018.
2. Principles of Physical Chemistry by B. R. Puri, L. R. Sharma, and Madan S. Pathania,Vishal Publishing, Forty Eighth Edition, 2021.
3. Fundamentals of Molecular Spectroscopy by C.N. Banwell and E.M. MacCash,5thEdition, McGraw-Hill Education, Fourth Edition, 2017.
4. Concise Inorganic Chemistry by J.D Lee, Oxford University Press; Fifth Edition, 2008.
5. Principles of Inorganic Chemistry by B.R. Puri, L.R. Sharma, and K.C. Kalia, VishalPublishing, Fifty Fifth Edition, 2020.
6. Stereochemistry: Conformation and Mechanism by P.S. Kalsi, New Age International,Eighth Edition, 2015.
7. Organic Chemistry Concepts and Applications by Jagdamba Singh, PragatiPrakashan,Eighth Edition, 2015.
8. Organic Chemistry byR.T. Morrison andR.N. Boyd, Pearson Education, Seventh Edition,2010.
9. Organic Chemistry: Structure and Function by P. Volhardt and N. Schore, WH Freeman;Eighth Edition, 2018.

Course Outcomes:

CO1: To demonstrate and realise the trend in various periodic properties associated withdifferent elements present in different groups and periods of modern periodic table.

CO2: To acquire the knowledge of free energy concept for the thermodynamics associatedwith chemical reactions and equilibriums.

CO3: To analyze and implement the concepts of spectroscopic techniques for identificationof various organic and inorganic compounds.

CO4: To evaluate and visualize the concept of configurations and conformations of variousorganic compounds

CO5: To assess the generation, reaction and identification of intermediates involved duringorganic reactions and their applications in different organic reaction mechanisms.

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	1	2	2	2	3
CO2	3	2	2	2	0	0
CO3	3	1	2	2	2	2
CO4	3	1	2	2	1	1
CO5	3	2	2	2	2	1

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) -: No Correlation

23ES1001 BASIC ELECTRICAL ENGINEERING (2-0-0)

MODULE I: (6 Hrs)
D.C Networks: Kirchoff's laws, node voltage and mesh current methods, delta-star and star-delta conversions, superposition principle, Thevenin's and Norton's theorems, Maximum Power Transfer Theorem.

MODULE II (6 Hrs)
Single phase and three phase ac circuit: Average and effective values of sinusoids, solution of R, L, C series circuits, solution of series and parallel circuits, series -parallel resonance. Line and phase quantities, Delta and star connections, solution of the balanced three phase circuits, measurement of power in three phase circuits.

MODULE III (6 Hrs)
Magnet circuit & principle of electromechanical energy conversion: Review of fundamental laws of electromagnetic induction, Solution of simple magnetic circuits. DC machine: Construction, types, emf equation of generator, torque equation of motor, speed control of DC motors

MODULE IV (6 Hrs)
AC MACHINES: Single Phase Transformer: Construction, emf equation, no load and load operation, voltage regulation and efficiency. Three Phase Induction Motor: Construction, principle of working, concept of slip, torque speed relation. Principle of operation of Three Phase alternator.

MODULE-V (6 Hrs)
Introduction to Power System: General structure of electrical power systems, Concepts of Generation, Transmission and Distribution, Sources of Electrical Power

ESSENTIAL READING

1. G. Rizzoni, Principles and Applications of Electrical Engineering, TMH , 2017
2. Nagrath I.J. and D. P. Kothari, Basic Electrical Engineering, Tata McGraw Hill.

SUPPLEMENTARY READING

1. S. Parker Smith, "Problems in Electrical Engineering", Asia Publications, 10th Edition.
2. Edward Hughes (revised by Ian McKenzie Smith), "Electrical & Electronics Technology", Pearson Education Limited. Indian Reprint 2002, 10th Edition.

Course Outcomes:
Upon completion of the subject the students will demonstrate the ability to:
CO1 Implement principles of DC network, theorems and transients.
CO2 Analyze the concept of Single phase and three phase AC circuits.
CO3 Express the concept of magnetic circuit and DC machines.
CO4 Apply basic principles of AC machines and their working.
CO5 Demonstrate basic principles of power system

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	1	1	2	1	-	-	-	-	1
CO2	3	3	2	1	1	2	1	-	-	-	-	1
CO3	3	3	2	1	1	2	1	-	-	-	-	1
CO4	3	3	2	1	1	2	1	-	-	-	-	1
CO5	3	3	2	1	1	2	1	-	-	-	-	1

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) -: No Correlation

Program Articulation Matrix row for this Course

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

23ES1002 BASIC ELECTRONICS (2-0-0)

COURSE OBJECTIVE:

1. To impart the fundamentals of semiconductor devices and their applications to various circuits.
2. To impart the knowledge offundamentals of digital electronics and Integrated Circuits (IC).
3. To impart the knowledge of electronic measuring instruments and fundamentals of communication systems.

MODULE I (7 Hrs)

SemiconductorPhysics:Properties of semiconductor, current flow in semiconductors, voltage -current characteristic of a p-n junctions, Rectifiers Bipolar junction Transistor (BJT): Device structure, types and modes of operation, static characteristic, BJT as a switch, BJT as an amplifier, conceptof biasing of BJT

MODULE II (7 Hrs)

JFET: Physical structure, operation and static characteristics
MOSFET: Physical structure, operation and characteristics ofD- andEtype MOSFET Integrated Circuits: Introduction to CMOS technology in VLSI,Introduction to Integrated circuits, Fabrication of monolithic IC, Integration of circuit components, Limitations of VLSI

MODULE III (6 Hrs)

Feedback Amplifiers: General feedback structure, properties of negative feedback, four basic types of feedback topologies (Block diagram only) Operational Amplifier (OP-AMP): Ideal OP-AMP, inverting configuration, non-inverting configuration, OP-AMP Applications (Adder, Subtractor only)

MODULE IV (5 Hrs)

Digital Electronicsfundamentals-Number system (Decimal, Binary, Octal and Hexadecimal), conversion amongnumber systems, signed-binary numbers, binary addition, subtraction, multiplication and division, logic gates, laws of Boolean Algebra,simplification of expressions

MODULE V (5 Hrs)

Electronic Instruments: Overview of CRO, DSO; principles of operation, waveform reconstruction, Comparison between CRO & DSO, applications of oscilloscope

Principles of Communication Systems: Fundamentals of AM & FM, (Waveforms and general expressions only)

ESSENTIAL READING

1. Electronics Fundamentals and Applications, D. Chattopadhyay and P.C. Rakshit, New Age International Publications. (Selected portions fromchapters)
2. Electronic Devices & Circuit Theory, R.L. Boylestad and L.Nashelsky, PearsonEducation.

SUPPLIMENTARY READING

1. Integrated Electronics, Millman and Halkias, TMHPublications.
2. Microelectronics Circuits, A.S Sedra, K.C. Smith, Oxford UniversityPress.
3. VLSI Design, Debaprasad Das, Oxford University Press.
4. Electrical & Electronics Measurement and Instrumentation, A.K. Sawhney, Dhanpat Rai & Co(Pvt.) Ltd

COURSE OUTCOME: After completion of the course, students should be able to

1. Understand theoperationand application of semiconductor devices.
2. Analyze characteristics of FETs.
3. Apply the Feedback Amplifiers and Operational Amplifiers.
4. Remember the fundamentals of different Digital arithmetic operations

23ES1003 PROGRAMMING IN C AND DATA STRUCTURE (3-0-0)

Pre-requisites Fundamentals of Computers

Course Objectives:

1. Learn fundamentals of C programming
2. Learn various steps of program development and implementation
3. Learn different Data Structures for structured programming approach
4. Learn relation of memory and memory referencing with the program execution
5. Learn to implant small projects

Module I (10 Hrs)

Fundamentals of C

Problem-solving processes: Algorithms and Flow Chart. C as a Middle-level language, Structure of C program, Character set Identifiers, Keywords, Data Types, Constant and Variables, Statements, Input and Output statements, Operators and Expressions, Precedence of operators, Control Structures (If, Ifelse, Switch-case, For loop, While, do-While)

Module II (9 Hrs)

Function, Array, Structure and Union Functions (Built-in, user-defined), Recursive function. Array: 1 – D, 2 – D, Matrix operations, String, Passing Array to Function, Structure, Union.

Module III (8 Hrs)

Pointer & Dynamic Memory Allocation

Pointer Arithmetic, Parameter passing using pointers, Call by value vs. Call by reference, Passing parameters, pointer to pointer, pointer to function, Pointer to Structure, Array and pointers, Static vs. Dynamic memory, Pointer variables, Dynamic memory allocation functions [malloc (), calloc (), realloc (), free ()]

Module IV (7 Hrs)
Data Structures
Introduction to Data Structure, Linear Linked List: Creation, Insertion, Deletion. Stack, Stack applications (Infix to postfix, postfix evaluation), Queue (linear & circular)

Module V (6 Hrs)
Tree, Introduction to Sorting & Searching Binary Tree, Binary Search Tree, Sorting (Bubble Sort, Quick Sort), Searching (Linear Search, Binary Search)

Essential Readings:
1. Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill
2. Programming in C, Pradip Dey, Manas Ghosh, Oxford Publication
3. Data Structures - (Schaum's Outlines), McGraw-Hill Education

Supplementary Readings:
1. Let us C- Yashwant Kanetkar, BPB Publications.
2. Programming with ANSI and Turbo C- Kamthane, A. N. Pearson Education
3. R. S. Salaria, Programming for Problem Solving, Khanna Publishing House
4. The C Programming Language – Brian W. Kernighan and Dennis M. Ritchie, Prentice Hall.
5. Data Structures Using C - Amiya Kumar Rath, Alok Kumar Jagadev, Scitech Publications.

Course Outcomes:
The students will learn and able to
1. Remember, understand and implement simple algorithms to C programs.
2. Test and execute programs using function, array, structure and union.
3. Analyze the relation of memory and memory referencing with the program execution.
4. Apply different Data Structures for problem solving.
5. Implement different sorting and searching algorithms.

23ES1004 ENGINEERING MECHANICS (3-0-0)

Module I (10 Hrs)
Concurrent forces on a plane: Composition, resolution and equilibrium of concurrent coplanar forces, method of moment. General case of forces on a plane: Composition and equilibrium of forces in a plane, plane trusses, method of joints and method of sections.

Module II (6 Hrs)
Friction: Fundamentals and Problems involving friction, Ladder, Wedges. Principle of virtual work.

Module III (8 Hrs)
Parallel forces on a plane: General case of parallel forces, center of parallel forces and center of gravity, Centroid of plane and composite figures, Theorems of Pappus and Guildins. Moment of inertia: Plane figure with respect to an axis in its plane and perpendicular to the plane, Polar moment of inertia, parallel axis theorem.

Module IV (8 Hrs)
Rectilinear translation: Kinematics, Principle of dynamics, D Alembert?s Principle, Principle of work and energy for a particle and a rigid body, Conservation of energy, Principle of impulse and momentum for a particle and a rigid body, Conservation of momentum, System of rigid bodies, Impact, direct and central impact, coefficient of restitution.

Module V (8 Hrs)
Curvilinear translation: Kinematics, Equation of motion, Projectile, D Alembert?s principle of curvilinear motion. Kinematics of rotation of rigid body.

Essential Reading:
1. Engineering Mechanics: S. Timoshenko, D.H. Young, J.V. Rao, Sukumar Pati,5th Edition,2017 McGraw Hill.

Supplementary Reading:
1. Engineering Mechanics, Static and Dynamics, J. L. Meriam and L.G.Kraige, 9th Edition,2021, John Wiley & Sons, Inc.
2. Fundamental of Engineering mechanics, S Rajesekharan& G ShankaraSubramanium,3rd Edition, 2017, S. Chand .
3. Engineering mechanics: K. L. Kumar andVeenuKumar, 4th Edition,2017, Tata MC Graw Hill.

Upon completion of the subject the students will be able to:
CO1 Ability to analyze objects in static equilibrium including the determination of reactions, forces and moments.
CO2 Enrichfundamental concept offriction and demonstrate the analytical skills to solve the problems involving friction.
CO3 Assimilatingthe knowledge for determination of centroid and second moment of area of sectionsand their engineering applications.
CO4 To analyze the work done by forces, the energy transferred from one object to other and apply principle of work and energy conservation for realistic (/Practical) engineering problems.
CO5 Identify the various parameters in projectile motion. Apply the principle of dynamics to analyze the curvilinear motion of rigid bodies.

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	1	2	-	-	-	3	1	-	1
CO2	3	3	2	1	2	-	-	-	3	1	-	1
CO3	3	3	2	1	2	-	-	-	3	1	-	1
CO4	3	3	2	1	2	-	-	-	3	1	-	1
CO5	3	3	2	1	2	-	-	-	3	1	-	1

Program Articulation Matrix Row for this Course

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

23ES1005 BASIC CIVIL ENGINEERING (2-0-0)

Module I (6 Hrs)
Introduction to Civil Engineering: Various disciplines of Civil engineering, Importance of Civil engineering in infrastructure development of the country, interdisciplinary nature of construction projects. Residential Buildings: NBC Classification, Basic Components of a building: Basic requirement. Planning and Design of buildings: fundamental requirements, selection of sites, Introduction to building design: functional and structural design. Foundations: Classification, Bearing Capacity of Soil and related terms (definition only)

Module II (6 Hrs)
Fundamental Properties of Construction Materials: Physical, mechanical and durability properties. Construction materials: stone, bricks, cement, aggregate, mortar, concrete, timber, steel, non-ferrous metals, paint, plastic, glass, adhesive, tiles, composites(Definition, classification and application)

Module III (6 Hrs)
Importance of Transportation, Transportation modes i.e. Highway, railway, airways, water, pipe and conveyor – Basic Characteristics, advantages and disadvantages. Indian road transport system: Types of roads, classification of highway, urban roads: basic requirements and classification. Basic Components of a Road, Rigid and Flexible pavement (comparison only)

Module IV (6 Hrs)
Quantity of water: Sources of water, Per capita demand, drinking water standards, Public Water Supply System: Necessity and Basic lay out. Conventional water treatment process: Screening, Plain Sedimentation, Sedimentation aided with Coagulation, Filtration, and Disinfection (working principles only).

Module V (6 Hrs)
Irrigation: Importance of Irrigation, Classification of Irrigation projects, Irrigation system: Types, Field water distribution, Multipurpose river valley projects, Dams: Purpose, types. Layout of canal Irrigation system: components and definitions.

Essential Reading:

1. Basic Civil engineering, Gopi, S., Pearson Publication
2. Basic Civil Engineering, Bhavikatti, S. S., New Age.

Course Outcomes:
1. Able to understand the basics of civil engineering and fundamental aspects of building.
2. Able to get the brief overview of general aspect of building material.
3. Able to get brief idea about transportation modes and planning.
4. Able to get brief idea about drinking water standards and water treatment plant.
5. Able to get brief idea about irrigation network system.

23ES1006 BASIC MECHANICAL ENGINEERING (2-0-0)

MODULE-I (11 Hrs)

Thermodynamics: Systems, Properties, Process, State, Cycle, Internal energy, Enthalpy, Zeroth Law, First law and Second Law of Thermodynamics, Basic Concept Entropy, Properties of ideal gas, Properties of pure substances, Enthalpy, Specific volume, Internal energy and dryness fraction of steam, use of Steam tables. Related numerical.

MODULE-2 (8 Hrs)

Application of Thermodynamics: Single stage air compressor, Steam Power Plant, I.C. Engines (Brief Description on working principles with Schematic diagrams only)

Elements of Fluid Mechanics and Heat Transfer Properties used in Fluid Mechanics, Fluid Statics, Kinematics and Dynamics (Concepts only), Heat transfer and Classifications (Concepts only)

MODULE-3 (7 Hrs)

Introduction to Manufacturing: Classification of engineering materials, Material Properties, Manufacturing processes: Welding, Casting, Forming (Basics only)

MODULE-4 (4 Hrs)

Basic Power transmission devices: Belt, Gear drives, clutch, brakes. (Working principle only)

Introduction to Robotics: Robot anatomy, Joints and links and common robot configurations.

Essential Reading

1. Basic Mechanical Engineering by Pravin Kumar, Pearson
2. Basic Mechanical Engineering by A R Israni, P K Shah, BS Publications3. Text book of Elements of Mechanical Engineering, S T Murthy, Universities press
3. Basic and applied Thermodynamics by P. K. Nag, Tata McGraw Hill

Supplementary Reading

1. Basic Mechanical Engineering by.D. Mishra, P. KParida, S.S.Sahoo, India Tech Publishing company
2. Elements of Mechanical Engineering by J K Kittur and G D Gokak,Willey
3. Basic Mechanical Engineering by BasantAgrawal, C M Agrawal,Willey
4. Engineering Thermodynamics by P. Chattopadhaya, Oxford University Press

COURSE OUTCOMES

CO1: Comprehending the Law of Thermodynamics

CO2: Being aware of how crucial thermodynamics is to IC engines, power plants, refrigerators, and Heat Pump

CO3: Being aware of fluid mechanics and heat transfer concepts

CO4: Recognizing the functions of Engineering materials

CO5: Have a fundamental understanding of welding, Casting, Forming and other manufacturing techniques.

CO6: Recognizing fundamental power transfer mechanisms and aware of the fundamental robotics system.

23HS1001 UNIVERSAL HUMAN VALUES (2-0-0)

UNDERSTANDING HARMONY AND ETHICAL HUMAN CONDUCT

Module 1- Foundations of Value Education

Right Understanding, Relationship and Physical Facility (Holistic Development and the Role of Education), Understanding Value Education, Self-exploration as the Process for Value Education, Continuous Happiness and Prosperity - the Basic Human Aspirations, Happiness and Prosperity-Current Scenario, Method to Fulfil the Basic Human Aspirations.

Module 2-Harmony in the Human Life, Relationships and Society

Understanding Human being as the Co-existence of the Self and the Body, Distinguishing between the Needs of the Self and the Body, Achieving Harmony: Integrating Self and the Body, Harmony in the Family and Society, 'Trust'& 'Respect'–as Foundational Values in Relationship, Other Feelings, Justice in Human-to-Human Relationship, Understanding Harmony in the Society & Universal Human Order.

Module 3-Harmony in the Nature/Existence & Professional Ethics

Understanding Harmony in the Nature, Interconnectedness, self-regulation and Mutual Fulfilment among the Four Orders of Nature, Realizing Existence as Co-existence at All Levels, The Holistic Perception of Harmony in Existence, Natural Acceptance of Human Values, Humanistic Education, Humanistic Constitution and Universal Human Order, Competence in Professional Ethics – Ethical Decision Making&Transition towards Value-based Life and Profession.

23HS1002 ENGLISH FOR TECHNICAL WRITING (2-0-0)

Course Objective:

1. To develop awareness about the complexity of the communication process.
2. To provide learning environment to practice listening, speaking, reading and writingskills.
3. To assist the students to carry on the tasks and activities through guided instructions and materials.
4. To develop effective writing skills so as enable students to write in a clear, concise, persuasive manner
5. To acquaint students with a variety of forms of writing in professional world.
6. To effectively integrate English language learning with employability skills and training.

Module - I (6 Hrs)
Fundamentals of Technical Communication
1. Process of communication, types of communication (Verbal & Non Verbal)
2. Channels of business communication
3. Barriers to communication.
4. Bias free language
5. Cross-cultural communication

Module - II (6 Hrs)
Communicative Grammar Hours
1. Time and Tense
2. Passive and active voice
3. English Conditionals

Module - III (6 Hrs)
Sounds of English Hours- 06
1. Consonant sounds of English
2. Vowel sounds of English
3. Stress pattern: Syllable, Stress and Intonation.
4. Problem sounds for Indian speakers

Module - IV (6 Hrs)
Professional Communication for Workplace
Paragraph writing (The Seven Cs of Good Professional Writing)
Formal Letter Writing
Memo and Notice writing
Agenda and Minute writing
Report Writing

Module - V (6 Hrs)
Professional Communication for Employment
1. CV writing
2. Interview skills

Essential Reading:
1. Effective Technical Communication by M Ashraf Rizvi (Tata McGraw Hill)
2. Better English Pronunciations By J. D.O Conner (Cambridge University Press)

Course Outcome:
At the end of this course students will demonstrate the ability to
CO1: Understand the concept and nature of communication and the objective of Technical Communication relevant for the work place as Engineers.
CO2: Use suitable vocabulary and grammar with confidence and express their ideas both in speech and writing.
CO3: Evaluate their efficacy as fluent and efficient communicators by learning the voice-dynamics.
CO4: Write flawless business correspondence like formal letters, memos, notices, reports

23BS1201 PHYSICS LABORATORY (0-0-3)

List of Experiments:

1. Determination of acceleration due to gravity by using Bar pendulum
2. Determination of wave length of monochromatic light with the help of Newton's ring apparatus.
3. Determination of grating element of a diffraction grating using spectrometer
4. Study of resonance using sonometer for unknown frequency
5. Study of RLC Circuit
6. Determination of surface tension of water by capillary rise method
7. To draw the characteristics of a bipolar junction transistor
8. To determine the rigidity modulus of the material of a wire by using Barton's apparatus.
9. To determine e/m ratio
10. Magnetic field measurement from Helmholtz coil

Course Outcomes: Upon completion of the subject the students will demonstrate the ability to:

CO1 Express the idea of calculation of acceleration due to gravity at any place using the concept of oscillatory system and simple harmonic motion.
CO2 Demonstrate the working and operational technique to calculate the mechanical properties of fluid and other materials.
CO3 Evaluate the voltage, current, power and characteristics behaviour of the electronic devices.
CO4 Understanding the rigidity concept of solid materials.
CO5 Analyzing the electrical and magnetic field measurements and their applications.

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	1	3	2	1	1	3	3	1	1
CO2	3	3	2	1	3	2	1	1	3	3	1	1
CO3	3	3	2	1	3	2	1	1	3	3	1	1
CO4	3	3	2	1	3	2	1	1	3	3	1	1
CO5	3	3	2	1	3	2	1	1	3	3	1	1

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) -: No Correlation

23BS1202 CHEMISTRY LABORATORY (0-0-2)

Chemistry Laboratory (Any Ten Experiments):

1. Determination of the alkalinity in the given water sample.
2. Determination of the temporary and permanent hardness in the given water sample by complexometric titration using EDTA as standard solution.
3. Determination of amount of available chlorine in bleaching powder.
4. Standardization of potassium permanganate using sodium oxalate
5. Determination of amount of ferrous iron present in Mohr's salt.
6. Determination of the rate constant of a chemical reaction.
7. Estimation of calcium in Limestone

8. Determination of dissolved oxygen in water sample.
9. Determination of the partition coefficient of a chemical between two immiscible liquids.
10. Determination of the strength of given HCl solution by titrating it against NaOH solutionusing pH meter.
11. Conduct metric titration of strong acid and strong base.
12. Determination of viscosity of lubricating oil by Redwood viscometer.
13. Determination of flash point of a given oil by Pensky-Martens flash point apparatus.
14. To find out the concentration of a given potassium permanganate solution spectrophotometric method.
15. Synthesis of Aspirin/Paracetamol.

Essential Reading:

1. Practical Chemistry by D.N. Bajpai, O.P. Pandey and S. Giri, S. Chand Publishing,Revised Edition, 2010.
2. Practical Physical Chemistry by B. Vishwanathan and P.S. Raghavan, Viva Books, FirstEdition, 2012.

Course Outcomes:

CO1: To analyze the alkalinity and hardness value of the water sample.
CO2: To analyze the concentration of copper present in the solution.
CO3: To analyse kinetics of the reactions.
CO4: To gain hands-on experiences of pH meter, conductometer, and spectrophotometer.
CO5: To analyze viscosity and flash point of lubricating oils.

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	2	3	2	2	2
CO2	3	2	3	2	2	2
CO3	3	2	3	2	2	2
CO4	3	2	3	2	2	2
CO5	3	2	3	2	2	2

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) -: No Correlation

Program Articulation Matrix Row for this Course

	PO1	PO2	PO3	PO4	PO5	PO6
Course	3	2	3	2	2	2

23ES1201 BASIC ELECTRICAL ENGINEERING LABORATORY (0-0-3)

List of Experiments

1. Preliminary: Preparation of symbol chart for various systems & components as per ISS, to study the constructional & operational features for Voltmeter, Ammeter, Wattmeter, Frequency meter, multi-meter and Rheostat, Study of safety rules.
2. 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 singlephase induction machine.
3. Measurement of the armature & field resistance of D.C. Machine by volt-amp method.
4. Starting and speed control of a D.C. shunt motor

5. Study of BH Curve of ferromagnetic core.
6. Determination of open circuit characteristics (O.C.C) of D.C shunt generator when separately excited at different speeds and different excitation levels.
7. Calibration of a single-phase Energy Meter by direct loading.
8. Measurement of power & power factor of a single-phase circuit
9. Measurement of earth resistance and insulation resistance.
10. Verification of Thevenin and Norton's theorem

Course Outcomes

Upon completion of the subject the students will demonstrate the ability to:

CO1 Express the safety rules as per ISS and symbols of different electrical components and the use of various electrical instruments in the laboratory.

CO2 Demonstrate the working and operational characteristics of dc motor and dc generator.

CO3 Evaluate the voltage, current, power and power factor of choke coil and study BH curve of a ferromagnetic core.

CO4 Measure armature and field resistance of DC machines, earth resistance and insulation resistance and demonstrate the internal structure of different machines.

CO5 Analyze the connection and calibration of single phase energy meter

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	1	3	2	1	1	3	3	1	1
CO2	3	3	2	1	3	2	1	1	3	3	1	1
CO3	3	3	2	1	3	2	1	1	3	3	1	1
CO4	3	3	2	1	3	2	1	1	3	3	1	1
CO5	3	3	2	1	3	2	1	1	3	3	1	1

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) -: No Correlation

Program Articulation Matrix row for this Course

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
Course	3	3	2	1	3	2	1	1	3	3	1	1

23ES1202 BASIC ELECTRONICS LAB. (0-0-3)

SESSIONAL OBJECTIVE:

1. To provide engineering skills for circuit design on breadboard with electronic components.
2. To impart the knowledge on digital fundamentals and digital circuit design.
3. To analyze various electronic circuits such as BJT, FET, OP-AMPs etc.

Experiment No.

1. Familiarity with electronic components and devices(Testing of semiconductor diode, Transistor, IC Pins connection) Digital Multimeter should be used.
2. Study and use of CRO to view waveforms and measure its Amplitude and Frequency.
3. V-I Characteristics of a Semiconductor Diode
4. V-I (Output) Characteristics of N-P-N/P-N-P Transistor in CE Configuration
5. Measurement of pinch off voltage and plot transfer characteristics and drain characteristics of JFET.

6. Transfer characteristics and drain characteristics of MOSFET.
7. OP-AMP: Inverting and Non-Inverting Configuration. Record of Waveforms.
8. Verification of Truth table of Logic gates (AND, OR,NOT, NAND, NOR, EX-OR)
9. Half Wave and Full Wave Rectifier without Capacitor filter. Record of Waveforms, Measurement of Average and RMS value.
10. Implementation of digital circuit using Universal gates.

SUPPLEMENTARY BOOKS

1. Integrated Electronics, Millman and Halkias, TMH Publications.
2. Electronic Devices & Circuit Theory, R.L Boylestad and L. Nashelsky, Pearson Education.

SESSIONAL OUTCOME

After completion of the sessional student should be able to

1. Acquire basic knowledge on electronic devices and components
2. Design different electronics circuits using semiconductor diodes.
3. Analyze and develop the characteristics of BJT and FET Circuits
4. Implement Operational amplifier circuits.
5. Acquire knowledge on basic digital logic gates.

23ES1203 PROGRAMMING LAB. (0-0-3)

Experiment Details

Sl.No	Expt No.	Experiment Details
1	1	Write a program to print your Bio-data.
	2	Write a program in C to test the arithmetic operators.
	3	Write a program to find out the simple interest and compound interest with the given input data.
2	1	Write a program to test the logical, bitwise, unary and ternary operators with the given input data.
	2	Write a program to check an inputted year is leap year or not.
	3	Write a program to calculate the salary of an employee given his basic pay, DA, HRA and TA. Display the output in format of salary statement.
3	1	Write a program to enter the marks of a student in 4 subjects. Then calculate the total, Aggregate %, and display the grades obtained by the student.
	2	Write a program to enter a number from 1-7 and display the corresponding day of the week using switch case statement.
	3	Write a program using switch case that read 4 nos. and display a menu thatoffers 4 options: calculate total, calculate average, display the smallest, and the largest number.
4	1	Write a program to check a given number is palindrome or not.
	2	Write a program to generate prime numbers present between two given numbers.
	3	Write a program to print the following pyramid star pattern.

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5	1	Write a program that will accept an array, and find the largest number, smallest number, sum of the elements and average of the elements present in the array.
	2	Write program that will accept an array and sort the array in ascending order. Display both the unsorted and unsorted arrays.
	3	Write a program that will insert an element at a desired position of an array. Show the array before insertion and after insertion of the new element (Array, element and position will provided by the user)
6	1	Write a program to swap the value of two inputted variable using function. Show the initial value and value after swapping.
	2	Write a program to print the Fibonacci series using function.
	3	Write a program that will accept two matrices using function and multiply them using function and show the result using function.
7	1	Write a program to find the GCD among two given number using recursion.
	2	Write a program to accept student data in a structure and display the structure elements.
	3	Check a inputted string is palindrome or not using pointer.
8	1	Write a program to read and print an array of n numbers, then find out the smallest number and its position in the array. Perform all these operations using pointer and function.
	2	Write a program to implement realloc() and free().
	3	Declare a pointer; allocate a block of memory to it using Dynamic Memory Allocation. Input a set of integers to the allocated memory block. The display the set of numbers.
9	1	Write a program to implement insertion and deletion of an element using linked list.
	2	Write a program to implement Push and Pop operations in Stack.
	3	Write a program to implement insert and delete operations in Queue.
10	1	Write a program to implement Quick Sort algorithm using C.
	2	Write a program to search an element using Linear Search algorithm.
	3	Write a program to search an element using Binary Search algorithm.

23ES1204 COMMUNICATIVE ENGLISH & REPORT WRITING LAB.

Course Objective:

The purpose of the English lab is to involve students to actively participate in language learning exercises and get more practice than the traditional classroom environment. The primary role of the lab is to create an environment where students feel comfortable speaking the language theyare learning, and where they can get the help they need in their journey to learn English as asecond language. The lab further focuses

1. To provide a platform to the students to develop their language skills.
2. To strengthen their professional skills and To improve fluency in spoken English, to practice correct pronunciation and neutralize their mother tongue influence.
3. To provide hands-on training in Speaking, Listening, reading and writing skills.
4. To improve the fluency of students in spoken English and neutralize their mother tongue influence.

Assignment I	Self- introduction
Assignment II	Professional presentation

Assignment III	Power point presentation
Assignment IV	Situational conversational practice/ Role play
Assignment V	Review of a book/newspaper editorial/ movie
Assignment VI	Cover letter and CV writing
Assignment VII	Listening Practice
Assignment VIII	Group Discussion
Assignment IX	Mock Interview
Assignment X	Reading Practice

Course Outcome:

At the end of this course students will demonstrate the ability to

CO1: To acquire strategic competence to use both spoken and written language in a wide communication strategies. range of

CO2: To maintain good linguistic competence- through accuracy in grammar, pronunciation and vocabulary.

CO3: Speak English with proper pronunciation and intonation

CO4: Make effective oral presentations by interpreting and analysing data, pictures and videos and participate in Group Discussion on general topics

23ES1205 ENGINEERING GRAPHICS AND DESIGN LAB. (0-0-3)
(with AutoCAD)

1. Introduction to AutoCAD: Basic commands, Code provision of IS-696 regarding Lines, Lettering and Dimensioning.
2. Drawing of Scales (Plane Scales, Diagonal Scales, Vernier Scales and Scales of Chords).
3. Construction of simple geometrical figures and Engineering curves.
4. Orthographic Projections:
   - i) Projection of a point situated in various quadrants.
   - ii) Projections of straight lines.
   - iii) Projection of plane figures.
   - iv) Projection of simple solids.
   - v) Section of solid and Development of surfaces.
5. Isometric projection and perspective view.

Essential Reading:

1. N. D. Bhatt, Geometrical Drawing, Charotar Book Stall, 2002.

Supplementary Reading:

1. K. Venugopal, Engineering Drawing and Graphics + AutoCAD, New Age International (P) Limited. 4th Reprint: June, 2008.
2. K. L. Narayana and P. Kannaiah, Engineering Graphics, Tata McGraw Hill Publishing Co. Ltd.
3. J. D. Bethune, Engineering Graphics with AutoCAD, Pearson Education.

23ES1206 Workshop and Digital Manufacturing Laboratory (0-0-3)

1. Preparation of job in fitting section/Study of lathe and turning operation
2. Preparation of job in black smith section/ Study of milling machine and milling operation.

3. Preparation of job in carpentry section/milling operation on CNC milling machine.
4. Study of CNC lathe machine and turning on CNC lathe.
5. Study of Robot (Pick and place and palletizing operation).
6. Study of additive manufacturing using 3D printer and product development.

1. Carpentry Section: Study of different Hand tools, measuring instruments and equipments used in Carpentry work. Safety precautions.

Preparation of Job: Carpentry job involving different types of joint.

Includes the operations: Measuring, Marking, Sawing, Planing, Chiseling, Mortesing, Tenoning, making Half-lap joint, Mortese & Tenon joint and Nail joint.

2. Fitting Section: Study of different Hand tools, measuring instruments and equipments used in Fitting work.

Safety precautions. Study of Drilling Machine and Grinding Machine.

Preparation of Job: Paper Wt. / Square or Rectangular joint (male-female joint) (any one)

Includes the operations: Measuring, Marking, Filing, Sawing, Drilling, Tapping, Dieing and Punching.

3. Black Smith Section:Study of different Hand tools, equipments and Open hearth furnace used in Blacksmith work. Different types of heat treatment processes. Safety precautions.

Preparation of Job: Weeding hook/ Chisel (any one)

Includes the operations: Measuring, Marking, Cutting, Upsetting, Drawing down, Bending, Fullering and Quenching.

4. Turning/ Milling Section(Conventional & CNC)
   A. Study of Lathe Machine, different parts of Lathe and different applications of Lathe. Study of different measuring & marking instruments.
   B. Study of Milling Machine, different parts and applications of Milling Machine. Study of different measuring & marking instruments.
   C. (i) Study of CNC Lathe Machine, different parts of CNC Lathe and its operation.
      (ii) Part programming for turning operations.
   D. (i) Study of CNC Milling Machine, different parts of CNC Milling Machine and its operation.
      (ii) Part programming for milling operations.
5. Robotics Lab:
   A. Study of Robot.
   B. Pick and place operation, demonstration and explanation of code.
   C. Palletizing operation, demonstration and explanation of code.
6. Additive Lab
   Study of 3D Printer and demonstration of its operation.

Course Outcomes: At the end of the course, the student will be able to:

CO1 Acquire knowledge of conventional & CNC (Lathe and Milling Machine). CNC code and part programming for Milling and Turning operations. Different types of hand tool, measuring instruments and machine tools used in Fitting, Carpentry & Smithy work.

CO2 Know about different types of operations and joints performed in different shops i.e. in Fitting and Carpentry.

CO3 Explore learning about forging temperature of different types of ferrous metals and different types of operation (e.g. upsetting, edging, flattening and bending etc.) carried out on hot metals to prepare jobs.

CO4 Acquire knowledge for the preparation of different types of jobs by using conventional/CNC Lathe and Milling Machines (e.g. facing, step turning, knurling, drilling, boring, taper turning, thread cutting and different methods of indexing for machining gears.

CO5 Acquire skills in using different precision measuring and marking instruments. Understand the importance of safety precaution in different shops.

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	-	-	2	2	1	1	3	1	2	1
CO2	-	-	1	-	2	2	1	1	3	1	2	1
CO3					1	2	1	2	3	1	2	1
CO4					3	2	1	1	3	1	2	1
CO5	-	-	-	-	-	-	-	1	2	1	1	1

23BS1004 MATHEMATICS - II (3-0-0)

Course Objective

The objective of this course is to familiarize the prospective engineers with techniques in ODE, PDE and Fourier analysis. It aims to equip the students to deal with advanced level of mathematics and applications that would be essential for their disciplines.

Module-I (8 Hrs)

First order ODE :

Exact ODEs. Integrating factors. Linear first order ODEs. Nonlinear first order ODE and Bernoulli's equations, Applications to Population growth, Newton's law of cooling, RL circuit.

Module-II (8 Hrs)

Second order ODE :

Second order linear differential equations with constant coefficients, Euler-Cauchy equations, method of undetermined coefficients, solution by variation of parameters. Power series solutions of ODE. Legendre's equations (explicit solution only).

Module- III (8 Hrs)

Vector Calculus :

Vector and Scalar Functions and Fields, Derivatives, Gradient of a Scalar Field, Directional Derivative, Divergence of a Vector Field, Curl of a Vector Field, Line Integrals, Path Independence of Line Integrals, Double Integrals, Green's Theorem in the Plane (Statement and applications)

Module- IV (8 Hrs)

Complex Analysis :

Limit, Continuity, Derivative, Analytic Function, Cauchy-Riemann Equations, Laplace's Equation, Exponential Function, Trigonometric and logarithm functions.

Module- V (8 Hrs)

Complex Analysis :

Line Integral in the Complex Plane, Cauchy's Integral Theorem, Cauchy's Integral Formula, Derivatives of Analytic Functions, Laurent series, Residue theorem with simple problems.

Essential Reading:

1. Erwin Kreyszig, Advanced Engineering Mathematics, 10th Edition, John Wiley & Sons, 2006.

Supplementary Reading:

1. E.M. Stein, Fourier Analysis: An Introduction (Princeton Lectures in Analysis)
2. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008.
3. S. L. Ross, Differential Equations, 3rd Edition, Wiley India, 1984.
4. E. A. Coddington, An Introduction to Ordinary Differential Equations, Prentice Hall India, 1995.
5. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2008.

Course Outcomes:

CO1: The effective mathematical tools for the solutions of differential equations that model physical processes.
CO2: Apply differential equation in real life engineering problems.
CO3: Application of modeling in differential equation.
CO4: To know about complex functions.
CO5: To familiar with application of complex integration.

SYLLABUS

FOR

FIRST YEAR

MBA PROGRAMME

(Effective from 2024-25)

2024-25

BIJU PATNAIK UNIVERSITY OF TECHNOLOGY, ODISHA

ROURKELA

COURSE STRUCTURE

FIRST SEMESTER

Category	Subject Code	Subject	L-T-P	Credit	University Marks	Internal Marks
THEORY						
1. PC	MBPC1001	Management Principles & Organizational Behaviour (MPOB)	3-0-0	3	100	50
2. PC	MBPC1002	Marketing Management	3-0-0	3	100	50
3. PC	MBPC1003	Financial Accounting and Analysis	3-0-0	3	100	50
4. EV	MBEV1001	Managerial Economics	3-0-0	3	100	50
5. QT	MBQT1001	Quantitative Techniques	3-0-0	3	100	50
6. EV	MBEV1002	Business Communication	3-0-0	3	100	50
7. EV	MBEV1003	Universal Human Values, Ethics and Environment	3-0-0	3	100	50
8. EV	MBEV1004	Entrepreneurship & Legal environment	3-0-0	3	100	50
9. EV	MBEV1005	Management Lessons from Ancient India	2-0-0	2	100	50
	Total		**26-0-0**	**26**	**900**	**450**
SESSIONAL / PRACTICAL						
10. PC	MBPC1201	IT Skills for Managers	0-0-2	2	-	100
11. EV	MBEV1201	Business Communication Lab	0-0-1	1	-	100
		Total	**26-0-3**	**03**	**-**	**200**
		Total Semester		**29**	**900**	**650**
		Grand Total (Theory + Practical) = 1550				

SECOND SEMESTER

Category	Subject Code	Subject	L-T-P	Credit	University Marks	Internal Marks
THEORY						
1. PC	MBPC1004	Corporate Finance	3-0-0	3	100	50
2. PC	MBPC1005	Cost and Management Accounting	3-0-0	3	100	50
3. PC	MBPC1006	Human Resources Management	3-0-0	3	100	50
4. QT	MBQT1002	Business Research	3-0-0	3	100	50
5. PC	MBPC1007	Operations Management	3-0-0	3	100	50
6. PC	MBPC1008	Business Analytics	3-0-0	3	100	50
7. PC	MBPC1009	Management Information System	3-0-0	3	100	50
8. PC	MBPC1010	Strategic Management	3-0-0	3	100	50
9. PC	MBPC1011	Introduction to AI	2-0-0	2	100	50
	Total		**26-0-0**	**26**	**900**	**450**
SESSIONAL / PRACTICAL						
10. EV	MBEV1202	Health & Wellness	0-0-1	1	-	100
		Total	**26-0-1**	**01**	**-**	**100**
		Total Semester		**27**	**900**	**550**
		Grand Total (Theory + Practical) = 1450				

MBEV1001 MANAGERIAL ECONOMICS (3-0-0)

Course Objectives:

1. To lay an adequate theoretical foundation to study various applied fields in economics and management.
2. To demonstrate the application of economic theory to business decisions.
3. To develop a student's ability to think analytically about the economic forces at work in society.
4. To develop a framework which the students may use to analyze the overall behavior of a modern mixed economy.

Module – I

Relevance of economics for business decisions,Scope of Managerial Economics, Role of Managerial Economist and Business decision making. Demand Analysis – individual demand and market demand, Determinants of demand, Elasticity of demand and its measures in business decision making, Demand Estimation and demand Forecasting, Supply Analysis.

Module – II

Production functions: Short Run Production Function – Variable Proportions, Long Run Production Function - Returns to Scale; cost minimization and output maximization, various cost concepts, cost functions, Economies of scale and economies of scope (simple numerical problems to be solved).

Module-III

Market morphology, price and output determination under different market conditions: Perfect competition, monopoly, monopolistic competition, oligopoly, Descriptive pricing approaches: Full cost pricing, product pricing; Price skimming, penetration pricing. Input pricing; Concepts of consumption, saving, and investment, Phases of business cycle, Inflation, Fiscal and Monetary policies, National Income.

Course Outcomes:

CO-1: Adopt the managerial economics concepts for business decision making. Also know the law of demand, its exceptions and the use of different forecasting methods for predicting demand for various products and services.

CO-2: Analyse the different costs of production and how they affect short and long run decision. Derive the equilibrium conditions for cost minimization and profit maximization. Analyse economies of scale, diseconomies of scale and economies of scope.

CO-3: Learn about the short run and long run equilibrium of a firm and industry and also about different market structure and various pricing techniques.

CO-4: Analyse different phases of business cycle, Analyse the impact of cyclical fluctuation on the growth of business and lay policies to control business cycle.

Reference Books:

1. Managerial Economics, Geetika, Ghosh, Raychoudhury,TMH
2. Managerial Economics, Salvatre, Srivastava,Oxford
3. Managerial Economics, Keat, Young, Banerjee,Pearson,
4. Managerial Economics, H L Ahuja, S.Chand
5. Managerial Economics Theory and Applications, DM MithaniHPH

6. Managerial Economics, PL Mehta Sultanchand&Co.
7. Managerial Economics, DN. Dwivedi,Vikash

MBEV1002 BUSINESS COMMUNICATION (3-0-0)

Course Objectives:
The objectives of the course are:

1. To provide an overview of the process and types of communication including Business Communication
2. To familiarize the learners with different formats of organizational communication
3. To infuse the correct practices and strategies of effective business writing and business presentation.
4. To put in use the basic mechanics of grammar, usage, and punctuation.
5. To create awareness of employability skills.

MODULE-1: ORAL COMMUNICATION

Communication Basics: The process of communication (2-way Model): Sender, Message, Channel, Receiver, and Feedback. Barriers to Communication, Communication Flow in Organizations: The Grape-vine; Formal Channels- Downward, Upward; Horizontal; Diagonal. Non-verbal Communication: Kinesics, Oculesics, Proxemics, Chronemics, Haptics, Paralanguage, Appearance and Artifacts.

Language Skill 1 - Listening: Listening Vs. Hearing- Importance of the listening Skill- Types of Listening: Active Listening; Empathetic Listening; Content Listening; Critical Listening- Guidelines for improving the Listening skill.

Language Skill 2- Speaking: Guidelines for improving confidence, fluency, articulation, accent and voice modulation while speaking, Cell Phone Etiquette; Meetings: Preparing a Notice- cum- Agenda; Chairperson's role; Other role functions in a meeting; Minutes of a meeting.

MODULE-II: WRITTEN COMMUNICATION

Language Skill 3 – Reading: The Process of Reading; Sub skills of Skimming, scanning, inferring, guessing word-meaning, Using appropriate speed for various kinds of reading, correction of reading faults of eye-fixation, regression, finger-pointing, sub-vocalizing, Reading aloud, and indiscriminate use of the Dictionary. Critical Reading with analytical skills.

Language Skill 4- Writing: The Writing Process- Guidelines for composing effective business messages- Persuasive Techniques: Fundamentals of Persuasion, Components of Attitude - Cognitive, Affective, Behavioural (Ethos, Pathos, Logos & Syllogism) - AIDA - NLP (VAKOG), Appeals (Emotional & Rational).

Business Letter: Form; Formats; and Types: Structure of Routine and persuasive business messages, good-will, good-news, and bad-news messages.

Business Memo; Features of an effective business E-mail; Rules of Netiquette.
Preparing a Resume- Parts of a Resume- Resume Styles: Chronological, Functional, and Chrono- Functional- Resume Design- Job Application letter.

Writing Business Reports: Features of a good business report. Formats- Printed form, Memo, Letter, manuscript; Structure of a short Formal Report. Steps in planning and preparing a business report.

Writing a Case Analysis
Applied English Grammarfor Business Writing: English Verb types: Stative and Dynamic; Transitive and Intransitive; Main and Auxiliary verbs. Tenses- Subject Verb Concord- Active & Passive voice- Relative Clauses & Modifier Placement-Parallel Structures- Punctuation.

MODULE-III: EMPLOYABILITY SKILLS
Group Discussion: Difference between GD and Debate- Parameters of Performance evaluation in a GD: Awareness, Reasoning ability, Discussion Skills, Leadership, Openness, Assertiveness, Attentive Listening, Motivation and Enthusiasm- How to get prepared for GD- Some Dos and Don'ts.

Interviews: Types by purpose; 3 stages of an interview; how to prepare for an interview; how to answer FAQs; Following up with a letter of thanks.

Presentations: Their importance for a manager- Features of a good business presentation. Planning, Preparing & Structuring a PPT Preparation, Rehearsal & Delivery- Answering questions after the presentation- Overcoming stage fright- Importance of Body Language in presentations.

Communication in Global Environment:
Cross cultural communication
Technology in use - Video conferencing - Google Meet - Teams – Zoom: Arranging meetings
Social Media - Artificial Intelligence & Communication prompts.

Course Outcomes:
After the course, the students will be able to:
CO-1: Distinguish among various levels of organizational communication and communication barriers while developing an understanding of communication as an organizational process.
CO-2: Develop awareness of Techniques of active Listening and fluent speaking.
CO-3: Apply the reading strategies of Skimming, Scanning, and Inferring in the comprehension of the reading texts of various types.
CO-4: Demonstrate the ability to compose reasonably error-free business correspondence with brevity and clarity.
CO-5: Apply Creative thinking as well as critical thinking in preparing his/her resume, in writing Reports, and in taking part in Group Discussions, and in designing PPTs for presentation.
CO-6: Use appropriate communication skills in multicultural contexts, in social media, in web meetings, and in web browsing.

Text Books:
1. Communication Skills. Sanjaya Kumar & Pushpa lata, Oxford University Press.
2. Business Communication: Skills, Concepts, and Application- P.D Chaturvedi and Mukesh Chaturvedi, Pearson.
3. Business communication- Meenakhi Raman & Prakash Singh, OUP.

4. Business and Managerial Communication- Sailesh Sengupta, PHI learning
5. Bcom: Business Communication- A South Asian Perspective, Lehman, Dufrene & Sinha, Cengage Learning.
6. Effective Technical Communication, Ashraf Rizvi, McGraw Hill India.

MBEV1003 UNIVERSAL HUMAN VALUES, ETHICS AND ENVIRONMENT (3-0-0)

Course Objectives:

1. To develop students' understanding of the concept of Human Values and related issues.
2. To make students aware the importance of Harmony in self, family, society and nature.
3. To make the students understand the importance of ethical practices in business and governance.
4. To exhibit understanding of the importance of business environment and probable impact of environmental factors on a business.
5. To sensitize learner the link between environmental issues and business.

Module I- Universal Human Values (UHV)

Universal Human Values (UHV)– Introduction, Need for Value Education, Right Understanding, Mutual happiness and prosperity, Role of Education-Sanskar (Enabling the Transformation to Human Consciousness), Self-exploration- The Content and Process, Meaning of Happiness and Prosperity. Understanding Harmony in the Self-Harmony of the Self with the Body: Self-regulation and Health, Understanding Harmony in the Family -Feeling of Relationship as the Basis for Harmony in the Family, 'Trust' – the Foundational Value in Relationship, Respect– As the Right path to harmony in family, Affection, Care, Guidance, Reverence, Gratitude and Love as Values in Relationship.Understanding Harmony in the Society - Understanding Human Goal, Harmony from Family Order to World Family Order –Universal Human Order- From understanding self to Family order, Family cluster order, village cluster order, Nation order, and world family order.Understanding Harmony in Nature/Existence: Nature as Collection of Units: Harmony among the Four Orders- Physical order, Bio order, Animal order, and Human order. Mutual fulfilment among the Four Orders of Nature: Co-existence at all Levels. The Holistic perception of Harmony in Existence.

Case Study depicting business applications of Universal Human Values (UHV)

Module II- Business Ethics

Ethics& Business Ethics - Definition, Meaning, Importance, Nature & Scope. Factors influencing business ethics, Salient feature, Ethical principles in business. Theories of ethics-Absolutism vs. Relativism, Kohlberg stages of moral development. Managing ethical dilemmas, Ethical decision making, Employee and Business Ethics, Ethical and value-based leadership. Ethics in governance practices in corporates, Corporate scams and unethical practices. Ethical principles and practices in Marketing, Finance, HRand other disciplines. Promoting ethical culture in business organization.

Case Study depicting ethics in business to be discussed.

Module III- Environment

Natural environment; Ecology and environmental protection and sustainable development – Bio-diversity and environmental degradation issues, Managing natural disaster,

Environmental Legislations, Issues of global warming, terrorism, natural disasters. Issues relating pollution- causes, and control measures.Greening Management- Green policies and practices in corporates, Environmental Partnership, Environment Audit, Product Stewardship. Environment Management as Competitive Advantage, World Business Council for Sustainable Development (WBCSD) and its ten messages for business.

Business Environment: Meaning, nature and scope, economic and non-economic environment; internal and external environmental factors. Scanning of environment-methods and techniques of scanning (ETOP, SWOT).Economic Environment of Business: recent developments in Indian Economy. Non–Economic Environmental Factors: Non-Economic factors influencing business. Changes in Business and Industrial policy- Recent industrial policy, trade liberalization, from a Closed to Open economy.
Case Study depicting Business Environment.

Course Outcomes:

CO-1: Develop a comprehensive understanding of Universal Human Values (UHV) and their practical applications in personal, familial, societal, and business contexts.
CO-2: Analyze ethical principles and theories in business decision-making, fostering a culture of integrity, responsibility, and leadership.
CO-3: Evaluate environmental issues, regulations, and sustainable business practices to mitigate ecological degradation and promote corporate responsibility.
CO-4: Assess the dynamic business environment, including economic, political, and ethical dimensions, to navigate challenges and opportunities in diverse socio-economic landscapes.

Text Book(s)

1. A Foundation Course in Human Values and Professional Ethics by R R Gaur, R Asthana, G P Bagaria,Excel Books, New Delhi, 3rd Edition.
2. A Foundation Course in Holistic Human Health by S Asthana, A Shukla, TS Perumal- UHV Publication.
3. Business Environment – B N Ghosh, Oxford
4. Business Ethics – Murthy, HPH
5. K.S.Thakur, Business,Ethics and Environment, Publisher: Aadi Publications, Seller: Neha Publisher

Reference Books

1. E.F. Schumacher, 1973, Small is Beautiful: a study of economics as if people mattered, Blond & Briggs, Britain
2. A N Tripathy, 2003, Human Values, New Age International Publishers.

MBEV1004 ENTREPRENEURSHIP & LEGAL ENVIRONMENT (3-0-0)

Course objectives:

1. The aim of learning by putting business and law together is to Create and maintain functional skill spaces on spectrum of lawful insight for Learners whether they run business entities or work for the people running it.
2. Sensitize the students to understand entrepreneurship as a career and skills required.

Module- I

Entrepreneurship: Concept of entrepreneurship and intrapreneurship, Types of Entrepreneurs, Nature and Importance, Entrepreneurial Traits and Skills, Entrepreneurship as a career,Identification of opportunity and converting idea to reality, Role of family, Society, EDIs. Sickness of Small-Scale Industries, Causes and symptoms of sickness, cures of sickness, Role of Banks and Governments in reviving industries.

Start-up Environment: Definition and characteristics of start-ups, Types of start-ups (Social, impact based, rural start-ups), Start-up India policy, Start-up Odisha policy, Knowledge of Key Accelerators, Incubators and Mentors in India, Understanding their role and advantages and disadvantages.

Module-II

Law of Contract: Contract Act: Indian Contract Act, 1872, Agreement, Contract, Essentials of Contract (Offer & Acceptance, Consideration, Capacity of Parties, Free Consent, and Legality of Object), Performance and Discharge of Contract, Remedies for breach of contract, Quasi Contract and Contingent Contract.

Special Contract: Sale and agreement to sell, Condition and Warranty, Transfer of properties, Finder of Goods, Performance of Contract of sale, Unpaid seller and his rights.

Module-III

Company Laws: Indian Companies Act 2013, Salient features and Classes of Company. Lifting of corporate veil, Procedure of Incorporation and Certificate of commencement of business, Memorandum and Articles of Association, Doctrine of ultra vires and Indoor Management, Management of Company: Qualification, Appointment of Directors, Company Meetings, Resolutions, Winding-up of Companies and their modes.

Course Outcomes:

CO-1: Rationalise for studying Entrepreneurship Development and realizing that entrepreneurs are wealth creators in our society.

CO-2: Demonstrate a fundamental comprehension of business opportunities and implementing them practically.

CO-3: Discuss unique start-up or entrepreneurial ideas in groups and present a business plan that articulates and applies financial, operational, organizational, market, and sales knowledge to identify paths to value creation through 1) company formation (for-profit); 2) social innovation (non-profit); or 3) intellectual property licensing.

CO-4: Demonstrate an in-depth understanding of the Start-up ecosystem in India and become conversant with sources of new finances, use of technology, customer acquisition concepts, etc. The focus will be on creating sustainable businesses.

Text Books:

- Entrepreneurship Development and Management, Vasant Desai, HPH
- Entrepreneurship Management, Bholanath Dutta, Excel Books
- Entrepreneurial Development, Sangeeta Sharma, PHI
- Entrepreneurship Development by Khanka
- Entrepreneurship, Rajeev Roy, Oxford University Press
- Business Law –S R Mohapatra and S R Patra, HPH
- Business Law – N D Kapoor, S Chand
- Business Law – Pathak, Tata Mc Graw Hill

MBEV1005 MANAGEMENT LESSONS FROM ANCIENT INDIA (2-0-0)

Course Objectives:

1. To understand the evolution of management thought in ancient India and its relevance in modern times.
2. To analyse the management perspective present in Vedantic literature, focusing on principles applicable to contemporary management practices.
3. To examine the ethical and moral values, leadership qualities, and strategic management lessons derived from the Ramayana, the Mahabharata and the Bhagavad Gita.
4. To explore the management and economic principles elucidated in Kautilya'sArtha Sastra and the Jain texts.

Module- I

Introduction to Ancient Indian Knowledge System; Evolution of Indian management thought; Need of India oriented Approach.

Management perspective in Vedantic Literature.

Management lessons in the Ramayana: Ethical and moral values, leadership, governance, strategic alliance.

Management lessons in the Mahabharata and the Bhagavat Gita: Conflict management, Inspirational leadership, alternative perspective on work and performance

Module-II

Kautilya's management lessons: Qualities of a leader, functions and role of a leader, motivation and communication; Principles and practice of governance of a state and of a corporation; Economic Thought of Kautilya.

Management perspective in Jain Literature: Code of conduct, Four pillars of human values, Conflict resolution, Ethical management, Mahavira's Economics.

Management Lessons in Buddhist Literature: Team building, Personal development of team members, Knowledge management.

Course Outcomes:

After the course the students will be able to:

CO-1: Demonstrate a deep understanding of the ancient Indian knowledge system, including its philosophical, spiritual, and managerial dimensions, and apply this understanding to contemporary management challenges.

CO-2: Critically analyse the evolution of Indian management thought, recognizing key influencers and schools of thought, and synthesize these insights to develop a holistic approach to management.

CO-3: Evaluate the management perspectives presented in Vedantic, Jain, Buddhist, and epic literature (such as the Ramayana, Mahabharata, and Bhagavad Gita), identifying common themes and principles, and apply them to address complex organizational issues.

CO-4: Develop practical skills in leadership, governance, conflict resolution, ethical management, team building, personal development, and knowledge management, drawing from the rich tapestry of ancient Indian texts and adapting them to modern organizational contexts.

Text Books:

1. Management Practices and Thoughts in Ancient India, Khandelwal and Mohanty, Himalaya Publishing House
2. Relevance of Ramayana in Contemporary Times, Gupta, Agrawal and Sharma, IBA publications
3. Kautilya-The Artha Shastra, L.N. Rangarajan, Penguin books
4. Indian Models of Economy, Business and Management, P. Kanagasabapathi, PHI
5. Sri Bhagavad Gita for Managers, Khandelwal, Himalaya Publishing House.
6. "Indian Management and Leadership: Spiritual and Ethical Values for Corporate and Personal Success" by S. Ramaratnam: BLUEJAY BOOKS- 2007
7. "Indian Economic Development" by Uma Kapila: Academic Foundation; 2018
8. "The Mahabharata: A Modern Rendering" by Ramesh Menon Vol-1 & Vol-2, iuniverse-2006.

"The Bhagavad Gita" (translated by Eknath Easwaran), Nilagir Press, 2007

MBEV1201 BUSINESS COMMUNICATION LAB (0-0-1)

Course Objectives:

The objectives of the course are:

1. To improve LSRW skills.
2. To learn and practice communication skills in a business context.
3. To enhance reading and listening comprehension.

1. Listening exercises:
   - Listening with a focus on pronunciation: segmental sounds, stress, weak forms, intonation.
   - Listening for meaning: listening to a short talk /news bulletin.
   - Taking notes from a lecture/speech.
   - Comprehending conversation
2. Speaking exercises :
   - Giving a short speech on a topic of interest. Participate in debates.
   - Preparing for GDs, Interviews: Structured & Unstructured, Stress Interviews, Business Etiquette
   - Preparing Presentation, Making presentations before the top management.
   - Practice exercises on the common grammatical errors.
   - Role- plays to practice effective use of body language, para language and spatial communication.
3. Reading exercises :
   - Developing vocabulary, Improving reading speed & comprehension
   - Note making after reading a text.
   - Showing the main idea and supporting ideas and the relationship between them.
   - Analyzing news articles.
4. Writing exercises :
   - Practice in writing paragraphs, Précis writing
   - Managerial Writing: Business letters: request, invitation, proposal, sales reports
   - Managerial Writing: Ad copywriting using AIDA, appeals, cognitive dissonance, Preparing Press Releases, Press Notes

- Writing CVs and Resumes, AI Prompts & keywords
- Remedial measures to focus on correct use of English verbs, sentence structures, clause- types, Interrogation and parallel structures.

Course Outcomes:

CO-1: Create Documents
CO-2: Develop group communication skills.
CO-3: Demonstrate business etiquette.
CO-4: Demonstrate presentation skills.
CO-5: Understand and evaluate self to develop Emotional Intelligence
CO-6: Develop interviewing and responding skills.

Text Books:

1. English Language Laboratories, Nira Konar, PHI
2. Guide to Managerial Communication, Mary Munter, Pearson
3. Cengage Learning India, English Language Communication Skill – Lab Manual
4. Soft Skills for Everyone, Butterfield, Cengage
5. Campus to corporates, Sage Publication
6. A practical Course in Spoken English, Gangal, PHI

MBEV1202 HEALTH & WELLNESS (0-0-1)

Course Objectives:

1. To understand the importance of nutrition in preventing life-threatening diseases like cancer, hypertension, obesity, diabetes, and cardiovascular diseases.
2. To explore the components of physical fitness and differentiate between active and sedentary lifestyles, understanding their implications on health.
3. To examine the relevance of promoting holistic well-being in the modern world.
4. To learn various yogasanas, Pranayama, and meditation techniques for fostering a healthy mind-body connection and overall wellness.

Module-I: Introduction to Health & Wellness

Definition of health- WHO definition, definition as per Ayurveda; Importance of health in everyday life; Components of health- physical, social, mental, spiritual and its relevance; Concept of wellness: Mental Health & wellness; Mind- Body connection in health, concept and relation Implications of mind-body connections.

Module-II: Management of Health and Wellness

Stress Management and Relaxation Techniques: Understanding stress and its impact on health, Stress management strategies, Relaxation techniques, including yoga and meditation. Need and importance of yoga (Asanas and Pranayama), and meditation for healthy well-being.Preventive Healthcare and Disease Prevention: Role of preventive healthcare measures, Screening tests and immunizations, Lifestyle factors in disease prevention.

Course Outcomes:

CO-1: To understand the concept of health and wellness and its relevance in daily life.
CO-2: To be aware of the relation between mind-body and its relevance.
CO-3: To adopt healthy physical habits and behaviours for well-being.

Books:

1. A Text Book on Physical Education & Health Education Fitness, Wellness and Nutrition, Dr. A. K. Uppal, Dr. P. P. Ranganathan.
2. Dr. R. Nagarathna and Dr. H.R. Nagendra: Yoga and Health, Swami Vivekananda Yoga Prakashana,2002
3. B. C. Rai Health Education and Hygiene, Published by Prakashana Kendra, Lucknow.

MBPC1001 MANAGEMENT PRINCIPLES & ORGANIZATIONAL BEHAVIOUR (MPOB) (3-0-0)

Course Objectives:

1. To introduce the students with the fundamentals of management and its processes.
2. To facilitate the students in understanding individual, group behavior and organizational culture and climate impacting learning organisation.

Module-I: Foundations of Management

Introduction to Management and Administration, Evolution of Management, Management Levels; Managerial Roles and Skills; Management Functions: Planning,Organising,Staffing, Directing and Controlling, Management Process, Decision Making, Contribution in the filed of Management by Peter F. Drucker, Michel Porter, C.K. Prahalad, Barnand, McGregor, Rensis Likert and McKinsey.

Module-II: Organisational Behaviour- I

Introduction to Organization Behaviour, Nature, Scope, OB Model, Personality: Traits and types; Perception-Factors and Process, Employee Motivation - Values and attitude; Barriers to change attitude, Developing Emotional Intelligence at the work place, Interpersonal relation and Transactional Analysis.

Module-III: Organizational Behaviour- II

Group and Team- stages and effectiveness; Conflict Management process, Leadership-skills, roles, Styles (Managerial Grid), Women leadership in India.

Organizational culture, Organizational climate VS organization culture, Factors contributing towards creating and sustaining culture,Organization Design, Change Management- Change Model and Organizational Development, Learning organisation-Organizing Knowledge Resource.

Course Outcomes:

After completing this course, students should be able to:

CO-1: Define, remember, understand, explain and interpret various concept of Management and organizational behaviour, managerial levels, roles, and skills managerial functions. such as Planning,Organising,Staffing, Directing and Controlling.

CO-2: Analyse and identify various aspects of individual organizational behaviour such as personality, perception, values, attitude, motivation and their impacts.

CO-3: Evaluate group and team dynamics, including stages of development and factors influencing effectiveness, and assess leadership skills, roles, and styles, including the Managerial Grid and the role of leadership in organizational context.

CO-4: Integrate and implement important managerial and behavioural skills to empower the students to appreciate the requirement of behavioural code of conduct in the world of business.

Text Book:

1. Management, Stephen P. Robbins, Mary Coulter, Agna Fernandez, Pearson Education, 2018
2. Organizational Behavior, Fred Luthans, McGraw Hill, 2017 References:
3. Organizational Behaviour: Human Behaviour at Work, – John W. Newstrom, Tata McGraw Hill,2017
4. Organizational Behaviour –Text and cases by Aswathappa, 12th revised edition, Himalaya publication
5. Essentials of Management, Harold Koontz, Heinz Weihrich ,Mark V Cannice,2020
6. Behavior in Organizations, Jerald Green Berg & Robert A. Baron, Pearson Education,2010 5. Management and Organizational Behaviour, Subbarao P, Himalaya Publishing House,2017 6. Organizational Behaviour, Sarma, Jaico Publications,2009
7. Management and Organizational Behaviour, Paul Hersey and Ken Blanchard, PHI,2009
8. Organizational Behavior, Kavita Singh, Pearson 2010

Mode of Evaluation: Assignments, Quiz, Mid Term Tests, End Semester Examination

MBPC1002 MARKETING MANAGEMENT (3-0-0)

Objectives:

1. Understand the fundamental concepts and principles of marketing, including the distinction between selling and marketing, the marketing concept, and the significance of avoiding marketing myopia.
2. Analyze the marketing environment, distinguishing between macro and micro factors, and evaluate the importance of environmental analysis in strategic decision-making.
3. Develop proficiency in market segmentation, targeting, and positioning strategies, along with an appreciation for the role of consumer behavior in shaping marketing strategies.
4. Gain practical knowledge of product management, pricing strategies, distribution channels, and promotional techniques, including contemporary approaches such as digital marketing, relationship marketing, and green marketing.

Module-I

Definition & Functions of Marketing, Scope of Marketing, Marketing concept, Selling versus Marketing, Concept of Marketing Myopia. 80: 20 Principle, Introduction to the Concept of Marketing Mix, Bottom of the pyramid concept; Concept of Marketing Environment: Macro and Micro, Need for analyzing the Marketing Environment.

Module-II

Market segmentation, Bases for market segmentation, Targeting , Positioning; Meaning & importance of consumer behavior, Comparison between Organizational Buying behavior and consumer buying behavior, Buying roles, Five steps buyer decision process.
Contemporary Topics: Viral Marketing, Guerrilla Marketing, Societal and social Marketing, Relationship Marketing, Green Marketing , Digital Marketing, Network Marketing (Concepts only)

Module-III

Product: Classification of consumer products and industrial products, Product Mix,

NewProduct Development Process: Idea Generation to commercialization. Product Life Cycle, Strategies across stages of the PLC.Packaging&Labeling, Basicconceptof Branding Pricing Basics: Meaning, Importance of pricing, Factors Influencing pricing decisions., Pricing strategies andapproaches

Place: The Role of Marketing Channels: Channel functions & flows, channel levels. Channel conflicts and resolution (Overview only)Channel Options: Introduction to Wholesaling, Retailing, Franchising, Direct marketing, E- Commerce Marketing Practices.

Promotion: The role of marketing communications, Elements of promotion mix, IMC approach (Overview)

Course Outcomes:

CO-1: Identify the key analytical frameworks and tools used in marketing.
CO-2: Utilize the information of a firm's external and internal marketing environment to identify and prioritise appropriate marketing strategies.
CO-3: Examine the marketing function and the role it plays in achieving organisational success both in commercial and non-commercial settings
CO-4: Analyse 4 Ps of marketing and its application across industries.

Books:

- Marketing:Baines,FillandPage,Sinha,Oxford
- MarketingManagement–Kotler,Keller,Koshy, Jha,Pearson,
- MarketingbyLambHair Sharma,McDanielCengage Learning
- MarketingManagement,Ramaswamy&Namakumari,McGrawHill
- MarketingManagement–KKarunakaran,Himalaya PublishingHouse
- MarketingManagement–TextandCases,TapanKPanda,ExcelBooks
- MarketingManagement–J.PMahajan, Vikas
- MarketingManagement-Rudani,S Chand

MBPC1003 FINANCIAL ACCOUNTING AND ANALYSIS (3-0-0)

Course Objectives:

1. To familiarize the students with accounting principles and acquaint them with accounting mechanisms, process and systems so as to develop their skills of preparing financial statements.
2. To develop their ability to read annual reports and develop their skills to interpret financial statements.
3. To familiarize the students with different financial accounting concepts affecting stakeholders.

Module-I:

Introduction to Accounting: Accounting as a language and need for Accounting, Basic Terminologies of Accounting. External and Internal users of Accounting Information, Accounting concepts and conventions, Accounting cycle, Accounting Equations, Nature of GAAP, Need for Accounting Standards, Limitations of Accounting, Ethical Issues in Accounting, Mechanics of Accounting: Introduction, Classification, Double Entry System, Preparing Journal, Subsidiary books, Ledger, preparation of Trial Balance.

Module- II:
Preparation of Financial Statements: Income statement and Balance Sheet, Corporate Accounts: Share and Share Capital, Issue of Shares, Payment in installment, Buyback of shares, Debentures and Bonds, understanding Corporate Income statement and Balance Sheet as presented in the Annual Reports of companies.

Module-III:
Financial Statement Analysis: Analysis and interpretation of Financing Statements, Common size statement, Comparative statement analysis, Trend analysis, Ratio Analysis, Cash Flow Analysis as per IND AS 7.

Course Outcomes:
CO-1: Explain the role of accounting as a language for financial communication of businesses, and meet the needs of both external and internal users using accounting principles.
CO-2: Illustrate the complete accounting process, including journalizing transactions, posting them to ledger, maintaining subsidiary books, preparing trial balance and drawing the financial statements for sole traders.
CO-3: Demonstrate a comprehensive understanding of corporate accounts, including the concepts of shares, share capital, the issuance of shares, instalment payments, share buybacks, and the use of debentures and bonds in corporate financing.
CO-4: Analyse corporate financial statements using techniques like Common Size Statement, Trend Analysis, Ratio Analysis, and Cash Flow Analysis as per IND AS 7.

Text Books:

1. Financial Accounting for Management; Paresh Shah,Oxford
2. Financial Accounting A managerial Perspective-Bapat & Raitha, McGrawHill
3. Financial Accounting for Managers-Sanjay Dhamija,Pearson
4. Accounting for Business Managers- Sakshi Vasudeva,HPH
5. Financial Accounting for Management,A.K.Bhattacharya
6. Financial Accounting for Management,Narayanswamy
7. Financial Accounting by S.N Maheswari VikasPublications
8. Financial Accounting by Satapathy, Mohapatra, Patra,Vrinda

MBPC1004 CORPORATE FINANCE (3-0-0)

Course Objectives:
1. To provide students with concepts, techniques and tools of Financial Management.
2. To study, analyze and improve their knowledge on financial management practices of an organization

Module I:
Foundations of Finance: Nature &Scope. Organization of Financial Functions. Emerging role of FMs in India and in Global context. Financial Goal. Agency problems. Time value of money, Compounding and discounting. Short term and long-term sources of fund.

Module II:
Investment Decisions. Capital Budgeting: Features, types and Techniques of capital budgeting decision. Cost of Capital. Financing Decision: Operating Leverage, Financial

Leverage. Capital structure. Theory and Policy. Dividend Decision Dividend Theory, Dividend Policy.

Module III:
Current Assets Management: Working Capital concepts, Policies, estimation, factors affecting working capital, Sources of financing Working Capital, Management of Cash: Cash budget, Management of collections and disbursement, Investment of Surplus cash; Management of Receivables: Terms of Credit, Credit Policy decision; Management of Inventory: Techniques of Inventory planning and control.

Course Outcomes:
CO-1: Explain the foundational concepts including finance functions, financial goals, agency problems, time value of money, risk and return concepts, and various sources of funds.
CO-2: Interpret the concepts of cost of capital and apply various capital budgeting techniques to evaluate investment proposals.
CO-3: Describe the capital structure and its theories, analyse the impact of leverage on financing decisions, and apply dividend theories for effective dividend policies.
CO-4: Identify strategies for effective current assets management including cash, receivables, and inventory to take working capital decisions.

Text Books:
- Fundamentals of Financial Management, Van Horne,Pearson
- Financial Management, G Sudarsan Reddy, HPH
- Essentials of Financial Management, IM Pandey, Vikas
- Financial Management, Khan & Jain, McGraw Hill,
- Financial Management, Srivastav &Misra, Oxford.
- Financial Management – Tulsian (S Chand)
- Fundamentals of Financial Management, Brigham, Cengage
- Financial Management by Prasanna Chandra , Tata McGraw Hill

MBPC1005 COST AND MANAGEMENT ACCOUNTING (3-0-0)

Course Objectives:
1. To understand the concept Cost accounting & Management Accounting
2. To familiarize the students about various methods of costing followed in different organizations
3. To understand and apply the various marginal costing techniques for managerial decision making

Module-I
Introduction to Cost Accounting and Management Accounting: Basic concepts: Scopes. Types of Cost, Financial Accounting, Cost Accounting and Management Accounting., Methods of Costing, Techniques of Costing, Classification of Costs, Cost Centre, Cost Unit, Profit Centre, Investment Centre, Preparation of Cost Sheet, Total Costs and Unit Costs.

Module-II
Cost Accounting System: Material Cost Management: Material Cost Valuing material issues and stock, Overheads: Meaning and Importance, production overhead, Primary distribution and Secondary distribution, allocation and apportionment of cost. Absorption by production units, Methods, over and under absorption of overhead.

Module-III

Methods and Techniques: Job Costing, Contract costing and Process Costing, Joint Product and By Products. Service Costing: Transport, Hospital, Canteen, Marginal Costing: Nature and Scope, Marginal Cost Equation, Profit Volume Ratio, Break-even Chart, Application of Marginal Costing Techniques for managerial decision making: Make or Buy decision, selection of Suitable product Mix.

Management Tools: Budgetary Control: Functional budgets, Cost budget, Master Budget, Performance budgeting and Zero based budgeting. Flexible budgets. Standard Costing: Standard cost and standard costing, standard costing and budgetary control. Analysis of variances (Material, Labour and Sales), Cost Reduction and Cost Control.

Course Outcomes:

CO-1: Acquire, describe and explain fundamental knowledge of cost accounting concepts and identify the various elements to calculate the total cost and unit cost of a product or service.
CO-2: Evaluate and interpret different methods costing to ascertain and control the costs in manufacturing and service industries.
CO-3: Use costing techniques for short-term decision-making and product cost analysis.
CO-4: Illustrate and utilize advanced management tools for budgeting, standard setting, locating variances and evaluation of performance.

Books

- A text book on Cost and Management Accounting, M.N Arora,Vikas
- Cost and Management Accounting, S P jain, K L Narang, Simmi Agrawal, Kalyani
- Cost and Management Accounting , Colin Drury, Cengage Leaning
- Morden Cost and Management Accounting, M.Hanif, Tata McGraw Hill End Pvt.Ltd

MBPC1006 HUMAN RESOURCES MANAGEMENT (3-0-0)

Course Objectives:

1. To introduce and explain different phenomenon of Human Resource Management (HRM).
2. To enrich the students' understanding on HRM, which may enable them to implement the concepts in theworkplace.

Module I

Concept, Definitions and Objectives of Human Resource Management (HRM); Functions of HRM; Process of HRM; Evolution of HRM; Strategic HRM and its role in the organization; Human Resource Planning (HRP): Meaning and Process, Job analysis: Job description and Job specification; Recruitment: Meaning, Sources, Process and Yield Ratio; Selection: Meaning and Process, Tests and Interviews, Induction andSocialization.

Module II

Performance Appraisal: Meaning, Objective, Process and Methods; Potential Appraisal; Biases in performance appraisal; Methods of job evaluation; Meaning of Compensation; Types of compensation; Types of wages and theories; Wage differentials; Pay structure, Wage Law in India, ExecutiveCompensation.

Module III

Concepts of Career, Career planning process, Career Stages; Training & Development: Concept, Training need analysis and Methods of training (on-the-job and off-the-job training), Evaluation of Training effectiveness; Concepts of Promotion, Transfer and Separation, Organization Citizenship Behaviour, HRIS, Competency mapping, Talent Management, Employee engagement.

Course Outcomes:

CO-1: Explain & interpret different concepts, Functions & Processes of HRM.
CO-2: Apply different tools and techniques for managing human resources in an organization.
CO-3: Analyze, identify problems and develop skill sets in managing human resources in an organizational context.
CO-4: Integrate the knowledge of HR concepts to Plan and design human resource intervention & strategies for an organization.

Text Books:

1. HRM Text &Cases,Aswathappa,TMH.
2. Personnel &Human Resource Management, P.Subba Rao,HPH
3. Human Resource Management – VSP Rao ,Excel
4. Human Resource Management, Jyoti Venkates,Oxford
5. HR, Denisi and Sarkar,Cengage.

MBPC1007 OPERATIONS MANAGEMENT (3-0-0)

Course Objectives:

1. To understand the concepts, principles, problems, and practices of operations management.
2. To understand the importance of an effective operations strategy in an organization.
3. To understand the various production and operations design decisions and how they relate to the overall strategies of organizations.

Module I

Overview of Operations Management and Capacity Planning: Operations in Manufacturing and Services, Responsibility of Operations Manager, Operations Strategy and Competitiveness, Process Analysis, Job Design and Work Measurement; Capacity Planning – Concept, Types of capacity; Aggregate Planning - Relevant cost and strategies.

Module II

Facility Location and Layout, Inventory Management:Facility location - Factors, Techniques (single facility and multi-facility), Factor Rating Method, Centroid Method; Facility Layout – Concept, Types of layouts and Line Balancing, Inventory Management – concept, EOQ, MRP.

Module III

Scheduling, Project Management and Quality Management: Scheduling; Gantt Chart; Project Management – concept and technique PERT and CPM; Quality management – concept, quality design, control chart (X, R, P), TQM, introduction to ISO 9000 ISO14000 (EMS) , ISO 18000 (OHSAS) and ISO 22000.

Course Outcomes:

CO-1: Identify the elements of operations management and various transformation processes to enhance productivity and competitiveness.

CO-2: Analyse and evaluate various facility alternatives and their capacity decisions, develop a balanced line of production & scheduling and sequencing techniques in operation environments.

CO-3: Develop aggregate capacity plans and MPS in operation environments.

CO-4: Plan and implement suitable quality control measures in Quality Circles to TQM.

Text Books:

1. Production and Operations Management, K. Aswathappa, K. S.Bhat,HPH
2. Operations Management, Chase et.al – Tata McGrawHill.
3. Production and Operations Management , Panneerselvam ,PHI
4. Production and Operations Management , S.N Chary , Tata McGrawHill
5. Operations Management, Meenakhi Kumari,Cengage
6. Production and Operations Management, Kaniska Bedi,Oxford
7. Production & Operations Management, SP Singh, VikasPublication
8. Essentials of Operations Management by Scott T Young – SagePublication

MBPC1008 BUSINESS ANALYTICS (3-0-0)

Course Objectives:

1. Provide foundational knowledge of business analytics concepts (descriptive, predictive, and prescriptive) and their application to business decision-making.
2. Develop skills in data management and visualization using tools like R programming and exploratory data analysis (EDA).
3. Introduce advanced predictive analytics techniques, including regression, classification, and time-series forecasting.
4. Highlight real-world business analytics applications in marketing, finance, and supply chain management.

Module-I

Introduction to Business Analytics and its importance, Types of Analytics- Descriptive, Predictive, Prescriptive, Business Analytics Framework and Applications,Data Management and Governance- Data Collection, Cleaning, Integration and Data Warehousing and ETL Processes,Data-Driven Business Models

Module-II

Introduction R Programming, Descriptive Analytics Techniques- Exploratory Data Analysis (EDA),Descriptive Statistical Techniques (e.g., mean, median, mode),Data Visualization and Reporting,Predictive Analytics Techniques-Regression Analysis, Classification Models,Time-Series Forecasting, Clustering.

Module—III

Big Data Analytics Framework and Technologies, Industry Application- Marketing Analytics, Financial Analytics, Supply Chain Analytics,Customer Segmentation, Churn Analysis, and Risk Management,Real-World Case Studies in Business Analytics

Course Outcomes:

The course aims to help students:

CO-1: Apply business analytics techniques to solve practical problems.
CO-2: Use tools like R programming to analyze and visualize data.
CO-3: Understand predictive analysis methods such as regression and classification.
CO-4: Gain skills in marketing, finance, and supply chain analytics.
CO-5: Analyze big data to improve strategic decision-making.

Text Books

1. Prasad, R.N., & Acharya, S. (2011), Fundamentals Of Business Analytics. John Wiley & Sons.
2. Kumar, U.D. (2017). Business Analytics: The Science of Data-driven Decision Making.Wiley India.
3. JuliantPallant – "SPSS Survival: A step by step guide to data analysis using IBM SPSS" – McGraw Hill Education.
4. Daniel G. Murray - "Tableau Your Data!: Fast and Easy Visual Analysis with Tableau Software" - 2ndEdition

MBPC1009 MANAGEMENT INFORMATION SYSTEM (3-0-0)

Course Objectives:

1. Introduce foundational concepts, frameworks, and types of Management Information Systems (MIS) for effective implementation and management.
2. Familiarize students with strategic and operational systems like ERP, SCM, CRM, and their role in managing business functions.
3. Provide insights into emerging technologies, such as cloud computing and IoT, and their impact on business processes.
4. Develop skills in utilizing decision support and knowledge management systems for informed decision-making.

Module I

Introduction to MIS and Data Management

Introduction to MIS,Types of MIS, CCR framework, MIS capabilities, Role of Managers in IT Implementation and Adoption, Knowledge Management – Decision Support Systems, Expert Systems, Learning Management Systems, Executive Information Systems, Database Management Systems (DBMS) Concepts, Data Warehousing and Foundations of Business Intelligence

Module II

Strategic and Operational Support Systems

Strategic Enterprise Systems - ERP, SCM, CRM, SRM. Operational Support Systems - Manufacturing Systems, Sales and Marketing Systems, HRIS, Finance and Accounting Systems, Production and Inventory Systems. IT Strategy and Balanced Scorecard – IT strategies, IT- business alignment, balanced scorecard, cloud and vendor strategies

Module III

Emerging Technologies and Ethical Issues

Mobile and E-commerce – B2C, B2B and e-procurement, C2C and mobile commerce. Emerging Technologies – Cloud computing, Big Data Technologies, Internet of Things, Bring Your Own Device (BYoD,) Virtual Reality, Augmented Reality, Blockchain, Artificial Intelligence

Course Outcomes:

The course aims to help students:

CO-1: Apply MIS concepts to analyze and solve business problems using technology-drivenapproaches.

CO-2: Align IT strategies with business goals, effectively managing enterprise systems.

CO-3: Leverage emerging technologies to identify innovation opportunities.

CO-4: Use decision support and knowledge management systems for effective decision-making.

Text Books:

1. Louden, D. (2018). Management Information Systems: Managing the Digital Firm (15th ed.). Pearson.
2. R. De. (2018) MIS managing information system in business, government and society, publisher: willy. Second edition
3. Davis, G.B., & Olson, M.H.(2016).Management Information System. Tata McGraw-Hill.

MBPC1010 STRATEGIC MANAGEMENT (3-0-0)

Course Objectives:

1. To learn the major initiatives taken by a company's top management on behalf of corporates, involving resources and performance in businessenvironment.
2. To specify the Organization's mission, vision and objectives and developpolicies.
3. To understand the analysis and implementation of strategic management in strategic business units.

Module I

Strategy and Process: External & Internal Environment – Strategic Advantage Profile (SAP), Environmental Threat Opportunity Profile (ETOP), SWOC Analyses -Conceptual framework for strategic management, the Concept of Strategy and the Strategic Management Process – Stakeholders in business – Vision, Mission, Purpose, Objectives and Goals – Strategic intent – hierarchy of strategy – strategic business unit.

Module II

Industry Structure & Competitive Advantage:

Industry Analysis - Porter's Five Forces Model-Strategic Groups, Competitive Changes during Industry Evolution-Globalization and Industry Structure - Capabilities and competencies–core competencies-Low cost and differentiation - Generic Building Blocks of Competitive Advantage- Distinctive Competencies-Resources and Capabilities durability of competitive Advantage- Sustainable Competitive Advantage - Casestudy.

Module III

Strategy Implementation and Evaluation:

The genericstrategic alternatives – Stability, Expansion, Retrenchment and Combination strategies - Business level strategy- Strategy in the Global Environment-Corporate Strategy-Vertical Integration-Diversification and Strategic Alliances - Mergers & Acquisition (Concept) - Strategic analysis and choice – Business Portfolio Analysis – BCG Matrix and GE 9 Cell Model -Mc Kinsey's 7s Framework - Balance Score Card-case study.

Designing Strategic Control Systems- Matching structure and control to strategy-Implementing Strategic Change-Politics- Power and Conflict-Techniques of strategic evaluation & control-case study, Corporate Social Responsibility.

Course Outcomes:
CO-1: Interpret the concept of corporate strategy..
CO-2: Analyse the inter-linkages between the strategy of the organization and the structure of the organization.
CO-3: Identify the different levels of corporate strategy and able to chart strategies for the organisation that derive from both the external and internal analyses performed.
CO-4: Examine the reasons for developing Strategies and analyse the resources and capabilities of the organization.

Text Books:
1. Strategic Management & Business Policy, Azar Kazmi, TMH,
2. Strategic Management, R. Srinivasana, PHI,
3. Strategic Management, Haberberg&Rieple, Oxford ,
4. An Integrated approach to Strategic Management, Hill & Jones, Cengage ,
5. Strategic Management & Entrepreneurship, D.Acharya& A. Nanda,HPH

MBPC1011 INTRODUCTION TO AI (2-0-0)

Course Objectives:
The meaning behind common AI terminology, including neural networks, machine learning, deep learning, and data science.
1. What AI realistically can--and cannot—do
2. How to spot opportunities to apply AI to problems in your own organization
3. What it feels like to build machine learning and data science projects
4. How to work with an AI team and build an AI strategy in your company
5. How to navigate ethical and societal discussions surrounding AI

Though this course is largely non-technical, engineers can also take this course to learn the business aspects of AI.

Module-I
What is AI?
Introduction, Machine Learning, What is data?The terminology of AI, What makes an AI company?, What machine learning can and cannot do, More examples of what machine learning can and cannot do, Non-technical explanation of deep learning, Non-technical explanation of deep learning.

Module-II
Building AI Projects
Introduction, Workflow of a machine learning project, Workflow of a data science project, Every job function needs to learn how to use data, How to choose an AI project (Part 1), How to choose an AI project (Part 2), Working with an AI team, Technical tools for AI teams.

Module-III
Building AI in your Company
Introduction, Case study: Smart speaker, Case study: Self-driving car, Example roles of an AI team
AI Transformation Playbook (Part 1), AI Transformation Playbook (Part 2), AI pitfalls to avoid, Taking your first step in AI, Survey of major AI application areas, Survey of major

AI techniques
AI & Society
Introduction,A realistic view of AI, Discrimination / Bias, Adversarial attacks on AI, Adverse uses of AI, AI and developing economies, AI and jobs.

Course Outcomes:
CO-1: After completing the course, the students will be able to:
CO-2: Recognize fundamental AI concepts and vocabulary, discerning prominent figures in AI enterprises.
CO-3: Apply project methodologies in machine learning and data science, demonstrating adeptness in selecting and managing AI activities.
CO-4: Analyze deployment of AI solutions, and integrating advanced collaborative technologies for team synergy.
CO-5: Evaluate ethical dimensions of AI, perceptive biases, vulnerabilities, and societal consequences, development ethical awareness.
Reference Course Link
Course Link: https://www.coursera.org/learn/ai-for-everyone

MBPC1201 IT SKILLS FOR MANAGERS (0-0-2)

Course Objectives:
The aim of this course is:
1. Familiarize learners with essential office software tools and their applications in various settings.
2. Provide hands-on experience with Google Services and their integration into daily tasks.
3. Equip learners with Excel skills for efficient data analysis and reporting.
4. Introduce learners to the fundamentals of Database Management Systems (DBMS) and SQL for effective data management.

Module-I: Introduction to Office Software: Types of Office Software, Working with Google Services: Docs, Spreadsheet, Presenter, Sites, etc.

Module-II: Introduction to Advanced Excel: Getting started with Excel, working with Formulas & Functions and creating Charts & Graphs, Date Functions, Look Function. Statistical tools – use statistical functions such as average, Standard Deviation, IF function etc. Data analysis by using What IF, PIVOT table, Scenarios, Goal seek.

Module-III: Introduction to Database Management Systems (DBMS): Introduction to databases and their role in business, Types of databases (Relational, NoSQL, etc.), Database Management System (DBMS) functionalities, Advantages and limitations of using a DBMS, Entity-Relationship (ER) Diagrams for data modeling, Normalization Techniques (1NF, 2NF, 3NF)
Introduction to SQL (Structured Query Language), SQL concepts and syntax, Data Definition Language (DDL) - CREATE, ALTER, DROP statements, Data Manipulation Language (DML) - SELECT, INSERT, UPDATE, DELETE statements, working with queries (filtering, sorting, grouping, joining data).

Course Outcomes:

After completing the course, the students will be able to

CO-1: Proficiently apply the knowledge gained with essential office software tools and their diverse applications across various settings.

CO-2: Effectively integrate Google Services into their tasks, enabling streamlined workflows and enhanced productivity.

CO-3: Demonstrate competency in utilizing Excel for data analysis, including functions, formulas, and statistical tools.

CO-4: Gain proficiency in the principles of DBMS, encompassing database types, normalization, and SQL syntax, for efficient data management.

Reference Books:

- Foundations of Computing, 5th Edition, Sinha and Sinha, bpb publication
- Microsoft Excel Data Analysis and Business Modeling (Office 2021 and Microsoft 365) (Seventh Edition, Wayne L. Winston, PHI
- SQL ALL-IN-ONE, dummies for A Wiley Brand, 3rd Edition

MBQT1001 QUANTITATIVE TECHNIQUES (3-0-0)

Course Objectives:

1. To lay an adequate theoretical foundation to study various applied fields in statistics and decision science.
2. To understand role of quantitative techniques in managerial decision making.
3. To understand applications of various quantitative techniques in managerial settings.

Module-I

Statistical Methods:

Measures of central tendency and dispersion: Standard Deviation, Simple Correlation, calculation of correlation coefficient, probable error, Rank correlation. Regression: Linear regression, calculation of regression coefficients,

Module II

Linear Programming: Concept, Formulation & Graphical and Simplex Solution, Assignment Models: Concept, Flood's Technique / Hungarian Method, applications including restricted & multiple assignments. Transportation Models: Concept, Formulation, Problem types: Balanced, Unbalanced, Minimization, Maximization Basic initial solution using North West Corner, Least Cost & VAM, and Optimal Solution using MODI.

Module-III

Queuing Theory: Concept, Single Server (M/M/I,), Markov Chains & Simulation Techniques: Markov chains: Applications related to management functional areas, Decision Theory: Concept, Decision under risk (EMV) & uncertainty, Game Theory: Concept, Two players zero sum game theory with dominance, Pure & Mixed Strategy.

Course Outcomes:

CO-1: Demonstrate proficiency with statistical analysis of data. To lay adequate theoretical foundation to study various applied fields in statistics. To know how global business decisions depends on the statistical analysis of data and specific relationship between two or more variables.

CO-2: Develop the ability to build and assess data-based models. Quantitative analysis of data, problem solving approach and use of mathematical techniques.
CO-3: Recognize the importance and value of Operations Research and linear programming in solving practical problems in real business world. Interpret the transportation models' solutions and infer solutions to the real-world problems. Optimize the allocation of resources to Demand points in the best possible way using various techniques and minimize the cost or time of completion of number of jobs by number of persons.
CO-4: Recognize and solve game theory and Markove's chain. Know when simulation and dynamic programming can be applied in real world problems.
CO-5: Learn the context around which decisions must be taken, evaluate all factors involved developing possibilities, how to assess each possibility against set criteria to identify the best option and then how to develop that into a successful decision. Develop leadership quality to handle projects in real situation by using scientific tools, and implement suitable quality control measures.

Text Books

1. Quantitative Techniques for Management, Levine, Krehbiel, Berenson, Pearson
2. Quantitative Techniques in Management by N.D. Vohra Tata, McGraw Hill
3. Quantitative Techniques-Davis.B, Oxford
4. Operations Research by R. Pannerselvam, Prentice Hall
5. Statistics for Business and Economics; R P Hooda, Vikas
6. Operations Research by Nita Shah, Ravi Gor, Hardik oni, PHI
7. Business Statistics : J K Sharma, Vikas

MBQT1002 BUSINESS RESEARCH (3-0-0)

Course Objectives:

1. To equip the students with the basic understanding of the research methodology in changing business scenario.
2. To provide an insight into the application of dynamic analytical techniques to face the challenges, aimed at fulfilling the objective of business decision making.
3. To equip the students with the basic understanding of the research methodology in changing business scenario.
4. To provide an insight into the application of dynamic analytical techniques to face the stormy challenges, aimed at fulfilling the objective of business decision making.
5. To gain practical experience in using MS Excel and SPSS for forecasting and estimation.

Module I

Introduction to RM:

Meaning and significance of research. Importance of scientific research in business decision making. Types of research and research process. Identification of research problem and formulation of hypothesis. Research Designs. Primary data, Secondary data, Design of questionnaire; Sampling fundamentals and sample designs. Measurement and Scaling Techniques, Data Processing. Ethical conduct in research.

Module II

Data Analysis – I: Hypothesis testing; Z-test, t-test, F-test, chi-square test. Analysis of variance (One and Two way). Non-parametric, Test – Sign Test, Run test, Kruskal– Wallis test.

Module III

Data Analysis – II: Factor analysis, Multiple Regressions Analysis. Discriminant Analysis (Concept)

Report writing and presentation: Research Report, Types and significance, Structure of research report, Presentation of report.

Module IV (Business Research Lab: Using MS Excel and SPSS):

Descriptive Statistics in't' test, Testing of hypothesis, Chi-square, ANOVA, Correlation, Regression, Factor Analysis.

Course Outcomes:

CO-1: Utilize the knowledge of research methodology in solving various business problems.
CO-2: Distinguish various alternative course of action available for a particular situation.
CO-3: To introduce students to the tools and techniques of econometrics.
CO-4: To develop expertise in decision-making through the use of statistical tools and techniques.
CO-5: Judge and select best possible alternatives to solve business problems

Text Books:

1. Research Methodology by Khatua and Majhi, HPH.
2. Damodar Gujarati, Dawn C Porter, and Manoranjan Pal, Basic Econometrics, Mc Graw Hill
3. Research Methodology by Kothari, Newage
4. Research Methodology, by Deepak Chawla / NeenaSandhi (Vikas)
5. Management Research Methodology- Krishnaswamy,Pearson

Reference Books:

1. BRM by Zikmund / Babin / Carr / Adhikari / Griffin (Cengage)
2. Research Methodology, V. Upadade&A. Shende (S. Chand)
3. Business Research Methods by Prahlad Mishra, Oxford
4. Business Research Method by Cooper et.al, McGrawHill
5. Levin. Richard. I and Rubin. David. S 'Statistics for Management' Prentice-Hall
6. Brooks, Chris., 'Introductory Econometrics for Finance' Cambridge University Press
7. Hair, Anderson, Tatham and Black., 'Multivariate Data Analysis' Pearson Education India
8. Wooldridge M., Introductory Econometrics: A Modern Approach, Cengage Learning

Open Resources:

1. https://dbie.rbi.org.in/, https://data.oecd.org/

SYLLABUS

FOR

FIRST YEAR

INTEGRATED MBA PROGRAMME

(Effective from 2024-25)

2024-25

BIJU PATNAIK UNIVERSITY OF TECHNOLOGY, ODISHA

ROURKELA

COURSE STRUCTURE

FIRST SEMESTER

Category	Subject Code	Subject	L-T-P	Credit	University Marks	Internal Marks
THEORY						
1. EV	IMEV1001	English Language Communication	3-0-0	3	100	50
2. EV	IMEV1002	Business Organisation	3-0-0	3	100	50
3. QT	IMQT1001	Business Statistics	3-0-0	3	100	50
4. PC	IMPC1001	Basic Financial Accounting-I	3-0-0	3	100	50
5. PC	IMPC1002	Fundamentals of IT	3-0-0	3	100	50
	Total		**15-0-0**	**15**	**500**	**250**
SESSIONAL / PRACTICAL						
6. EV	IMEV1201	English Language Communication Lab	0-0-2	2	-	100
7. PC	IMPC1201	Information Technology Lab	0-0-2	2	-	100
		Total	**15-0-4**	**04**	**-**	**200**
		Total Semester		**19**	**500**	**450**
		Grand Total (Theory + Practical) = 950				

SECOND SEMESTER

Category	Subject Code	Subject	L-T-P	Credit	University Marks	Internal Marks
THEORY						
1. EV	IMEV1003	Business Communication	3-0-0	3	100	50
2. EV	IMEV1004	Social Psychology	3-0-0	3	100	50
3. QT	IMQT1002	Quantitative Methods-I	3-0-0	3	100	50
4. PC	IMPC1003	Basic Financial Accounting-II	3-0-0	3	100	50
5. PC	IMPC1004	Marketing Management-I	3-0-0	3	100	50
	Total		**15-0-0**	**15**	**500**	**250**
SESSIONAL / PRACTICAL						
6. EV	IMEV1202	Business Communication Lab	0-0-2	2	-	100
7. QT	IMQT1201	Advance Excel- Lab	0-0-2	2	-	100
		Total	**15-0-4**	**04**	**-**	**200**
		Total Semester		**19**	**500**	**450**
		Grand Total (Theory + Practical) = 950				

IMEV1001 ENGLISH LANGUAGE COMMUNICATION (3-0-0)

Course Objectives:

The objectives of the course are;

1. To provide an overview of the process and types of communication, causes of miscommunication, and strategies for effective communication
2. To familiarize the learners with requisites for using the four language skills, namely, Listening, Speaking, Reading, and Writing
3. To put in use the basic mechanics of grammar, usage, and punctuation.

ModuleI: Basics ofCommunication

The Process of Communication & its elements; Barriers to communication & Strategies for overcoming them, Non-verbal communication: Kinesics; Oculesics; Proxemics; Chronemics; Haptics; Paralanguage; Appearance and Artifacts. Communication network in an organization: The Grapevine; Downward, Upward, Horizontal and Diagonal Channels. 7Cs' of effective communication.

ModuleII: Listening,Speaking and Reading Skills

Listening: Importance; Types of listening: Active listening; Content listening; Empathic listening; Critical listening. Strategies for improving listening skills.

Speaking: Characteristics of Effective Speech- Clear articulation; Rate of speaking; Voice quality; Eye Contact; Relevance of content for the audience.

The Sounds of English, IPA symbols, The Syllable- Division of words into syllables – Problem sounds for Indian learners of English. Stress– Word stress, Contrastive Stress- Rules of Intonation (Falling and Rising tones) in English.

Reading: Developing reading skills of skimming and scanning; predicting, guessing the meaning of unfamiliar words, inferring; Extensive and Intensive Reading.

Module – III: The WritingSkill & English Grammar.

Writing: The Writing Process; Characteristics of effective writing: clear organization and structuring of ideas, clarity of language, stylistic variation. Paragraph writing; Summary/ précis writing; Note-making.

Applied English Grammar: English verb types: Main and Auxiliary verbs; Stative and Dynamic; Transitive and Intransitive. Tenses; Subject-verb concord; Non-finite forms; Conditionals & Relative clauses; Parallel Structures; Punctuation.

Course Outcomes:

After completing the course, the students will be able to:

CO-1: Apply conceptual knowledge to enforce the basic concepts of communication, identify and overcome potential barriers in communication and use proper verbal and nonverbal modes of communication in an organisation.

CO-2: Analyse and implement effective listening and speaking skills for proper articulation of words and sentences and maintain proper eye contact and prepare relevant content for audience.

CO-3: Develop effective reading skills and maintain clarity in writing styles along with structuring ideas for stylistic variation in writing.

CO-4: Use Basic Grammar effectively in writing and speaking.

Reference Books:

1. Communication Skills, Sanjay Kumar & Pushpa Lata,Oxford
2. An introduction to Professional English and Soft Skills: Das et al, BPUT TextBook.
3. Business communication- Meenakshi Raman & Prakash Singh, OUP.
4. Effective Technical Communication, Ashraf Rizvi, McGraw Hill India.
5. A University Grammar of English, Quirk et al,Pearson

IMEV1002 BUSINESS OGRANISATION (3-0-0)

Course Objectives:

1. To provide the students an understanding of the nature of business activities and the environments within which they function.
2. To provide the theoretical and practical aspects of the operation of the various types and forms of business organizations.
3. To develop an understanding of the role of business activities in the modern world.

Module-I

Introduction to business: Meaning of business; nature of business; objectives of business: essentials of a successful business; qualities of a successful businessman; Classification of industries; Modern Business Environment: Characteristics, Challenges; Business Processes.

Business organization: Meaning: characteristics of an ideal form of business organization. Different forms of Business Organization

Module-II

Sole Trader: meaning; features; merits and demerits.

Partnership: meaning, characteristics; kinds of partners; partnership deed; advantages and disadvantages of partnership form of business organization: dissolution of partnership firms and different forms of Cooperatives.

Joint Stock Company: Meaning and definition; characteristics: kinds of companies; distinction between private and public company. merits and demerits of company form of business organization;

Statutory Corporations: Features, Merits &Limitations ; Formation of a company: Process.

Module-III

Organizational Structure: Formal and informal organization-Line Organization, Line and staff organization, Delegation, Decentralization, structural configurations of functional, Divisional, Matrix, Network, Virtual and learning organizations: Federal decentralization, Principles underlying designing of a structure.

Course Outcomes:

CO-1: Explain the concept of the various constituents of organisations and their impact on businesses.

CO-2: Demonstrate and develop conceptual framework of business organisations and generate interest in business.

CO-3: Interpret the definition of ethics, the importance and role of ethical behaviour in the business world today.

CO-4: Explain different ways of classifying businesses by size industries, sectors and industries type.

Reference Books:

1. Modern Business Organisation Management-S. A Sherleker, Himalaya
2. Publishing House
3. Modem business Organisation-J P Mahajan- Himalaya Publishing House

IMEV1003 BUSINESS COMMUNICATION (3-0-0)

Course Objectives:

1. To familiarize the learners with different formats of organizational communication
2. To infuse the correct practices and strategies of effective business writing and business presentation.
3. To put in use the basic mechanics of grammar, usage, and punctuation.
4. To impart instructions for preparing impressive Resumes.
5. To make the students ready for effective Group Discussions and impressive performance in job interviews.

Module-I: Writing Letters, Memos,E-mail:

- The Writing Process; Guidelines for composing effective messages;
- Business Letter: Parts of a Business Letter; Formats for typing a business letter; Writing routine, good-news & bad-news messages; Writing persuasive messages.
- Business Memo;
- Effective e-mail writing; Rules of Netiquette.
- Business Report:Features of a good business report. Formats- Printed form, Memo, Letter, manuscript; Structure of a short Formal Report. Steps in planning and preparing a business report.

Module-II: Designing & Delivering OralPresentations:

- Presentations: Planning, Preparing, Practicing, and delivering oral presentations; Enhancing oral presentations with Visual aids; Overcoming Stage Fright; Importance of body language during presentations; Question-Answer session after the presentation.
- Meetings: Preparing a notice-cum-agenda; Chairperson's role; Other role functions in a meeting; Content of the minutes of a meeting.
- Cross cultural communication: Technology in use - Video conferencing - Google Meet - Teams – Zoom: Arranging meetings.
  Social Media - Artificial Intelligence & Communication prompts.

Module-III: Writing employment messages and taking part in GD & Interviews:

- Preparing resumes and Job application letters; Resume: Parts of a Resume- Resume Styles: Chronological, Functional, and Chrono- Functional- Resume Design- Job Application letter.
- Group discussion: Types; How to prepare for GD; Parameters of Evaluation; Role Functions in GD; Non-functional Behaviour Patterns in GD; Guidelines for Effective Group Discussions.
- Interviews: Types by purpose; 3 stages of an interview; how to prepare for an interview; how to answer FAQs; Following up with a letter of thanks.

Course Outcomes:

After completing the course, the students will be able to:

CO-1: Distinguish among various levels of organizational communication and

communication barriers while developing an understanding of communication as an organizational process.

CO-2: Develop awareness of Techniques of active Listening and fluent speaking.

CO-3: Apply the reading strategies of Skimming, Scanning, and Inferring in the comprehension of the reading texts of various types.

CO-4: Demonstrate the ability to compose reasonably error-free business correspondence with brevity and clarity.

CO-5: Apply Creative thinking as well as critical thinking in preparing his/her resume, in writing Reports, and in taking part in Group Discussions, and in designing PPTs for presentation.

CO-6: Use appropriate communication skills in multicultural contexts, in social media, in web meetings, and in web browsing.

Books:

1. Business Communication Today – Bovee, Thill,Schatzman
2. Business Communication, Meenakshi Raman & Prakash Singh,Oxford
3. Business Communication- concepts, cases & applications, Chaturvedi &Chaturvedi, Pearson
4. Communication for Management, Urmila Rai and S M Rai,HPH
5. Business and Managerial Communication, Sengupta, PHI 5. BusinessCommunication for Managers, P. Mehra,Pearson
6. BCOM- Business Communication, Lehman, Sinha,Cengage

IMEV1004 SOCIAL PSYCHOLOGY (3-0-0)

Course Objectives:

1. Understand the socio-cultural influences on human development and behavior
2. Exhibit the ability to work respectfully and constructively with individuals of different backgrounds, values, and experiences
3. Demonstrate the ability to integrate multicultural concepts into psychology research, theory, practice, and service to others
4. Describe key concepts, principles, and overarching themes in psychology

Module-I

Introduction: Definition, Scope, Methods and Branches of Psychology (with special reference to Industrial/ Organization Psychology) , Major Viewpoints- Behavioristic approach, Gestalt, School, Psychoanalytic School.

Module-II

Sensation, Attention and Perception: (a)Attributes and classification of sensation (b) Attention Determinants, Shift, Fluctions, Distraction, (C)

Module-III

Learning Process: Factors of Learning, Theories- Connectionism, Classical and Operant Conditioning, Programmed Learning.
Memory: Encoding, Storage, Retrieval, STM, LTM, Other types , Forgetting- its causes.
Emotion: Reaction (types) Psychological basis.
Intelligence: Definition, Concept of IQ, Emotional Intelligence
Personality: Definition, Types, Traits, Tests

Course Outcomes:

CO-1: Develop insight and analyse the contribution of social psychologists to the understanding of human society.
CO-2: Evaluate effective strategies in socialization, group processes (both inter and intra-group) and helping behaviour.
CO-3: Register the progression of theories in major areas in Social Psychology.
CO-4: Interpret attitude formation and various methods to be used to change the attitude.
CO-5: Interpret aspects related to social psychology.

Books:

- Atkinson, R.L., Atkinson, R.C. Smith, E.E. &Hilgrad, ER: Introduction to Psychology, Harcourt Brace Java Publisher.
- Baron, R.A: Psyshology: The Essential Science, Allyn and Bacon.
- Morgan, C.T., King, R.A. Weisz, J.R. and Schopler, J: Introduction to Psychology McGraw Hill
- Munn, NL, Ferland, L.D., and Freeland, P.S. : Introduction to Psychology, Oxford, IBH Publishing.
- Woodworth, R.S., &Scholsberg, H: Experimental Psychology, Oxford & IBH Publishing.

IMEV1201 ENGLISH LANGUAGE COMMUNICATION LAB (0-0-2)

Course Objectives:

1. To improve the learners' proficiency in Listening, Speaking, Reading and Writing skills in English.
2. To enhance their active vocabulary by at least 300 new words.
3. To enable them to speak words and sentences with correct pronunciation of English sounds and with proper stress and information.

Lab sessions will be used to provide practice activities based on the content of all three modules of theory, with particular emphasis on the following:

1. Listening exercises
   (i) Taking a dictation
   (ii) Listening with a focus on pronunciation: segmental sounds, stress, weak forms,intonation.
   (iii) Listening for meaning: listening to a short talk / newsbulletin.
   (iv) Taking notes from alecture/speech.
2. Reading exercises
   (i) Reading comprehension; Speed reading practice
   (ii) Note making after reading a text, showing the main idea and supporting ideas and the relationship between them.
3. Writing exercises
   (i) Practice in writing paragraphs based on a Topic Sentence,
   (ii) Writing a Summary/ Precis.
4. Phonemic transcription usingIPA symbols.
   (i) Transcription of words in normal English orthography(writing)into IPAsymbols
   (ii) Phonemic transcription of words presentedorally
   (iii) Syllable division and stress marking (in words presented inphonetic transcription)

5. Speakingexercises
   (i) Introducing oneself and others
   (ii) Pronunciation practice (for accent neutralization), particularlyof problem sounds, in isolated words as well assentences.
   (iii) Practicing word stress, andintonation.
   (iv) Practice of 2 Minutes' speech on a contemporary topic.
6. Vocabularyexercises

Course Outcomes:

After completing the course, the students will be able to:

CO-1: Use conceptual knowledge of communication and use effective body language and proper articulation by implementing rules of pronunciation.

CO-2: Analyse and implement effective listening and speaking skills for proper articulation of words and sentences and focus on accent neutralisation.

CO-3: Develop effective writing styles along with structuring ideas for stylistic variation in writing for effective documentation.

CO-4: Use Basic Grammar effectively in writing and speaking and implement remedial measures to improve the same.

Book for Reference:

1. English Communication Skills- Raman & Singh
2. Effective Technical Communication- Ashraf Rizvi.

IMEV1202 BUSINESS COMMUNICATION LAB (0-0-2)

Course Objectives:

1. To enable the learners to draft appropriate messages in Business Letters, Memos, and E-mails in the correct format.
2. To give the learners practice in making presentations.
3. To give them practice in preparing impressive Resumes
4. To impart the ability to actively participate in GDs and to perform satisfactorily in job interviews.

The following are the main Activities to be conducted in Lab classes.

1. Delivering short speeches of 2 Minutes' duration.
2. Delivering PPTPresentations individually and in teams.
3. Writing BusinessLetters
4. Writing Memos andE-mails.
5. GroupDiscussions
6. Mockinterviews
7. Vocabulary exercises

Course Outcomes:

After completing the course, the students will be able to:

CO-1: Draft business letters, memos and e-mails in the correct form with reasonable accuracy of content.

CO-2: Deliver effective PPT presentations both individually and in a group.

CO-3: Participate in group Discussions with adequate content and analysis.

CO-4: Internalise effective techniques of answering questions and interacting in job interviews.

CO-5: Attain fluency in speech with enhancement of active vocabulary by at least 150 new words.

Reference Books:

1. English Language Lab, Nira Kanor, PHI
2. Guide to managerial Communication, Mary Munter,Pearson

IMPC1001 BASIC FINANCIAL ACCOUNTING - I (3-0-0)

Course Objectives:

1. To understand the need of accounting for a business.
2. To familiarize the students about the process of Accounting.
3. To know about the result of a business reflected by accounting statements.

Module -I

Introduction: Accounting as a language of business and need of Accounting, Accounting & Book keeping, Importance & objectives of Accounting, Basic Terminologies, users of accounting information, limitations of accounting, Accounting concepts &conventions, Accounting Standards, Accounting Equation and effect of transactions on Accounting Equation.

Module- II

Accounting Cycle, Type of Account, Journal, meaning, steps in Journalizing, golden rules for journal. Leger as book of secondary entry, process of ledger posting, Subsidiary book: Cash book single column, double column, triple column cash book and petty cash book, TrialBalance, meaning objectives and methods of preparing Trial Balance

Module- III

Capital Expenditure, Revenue Expenditures and Deferred Revenue Expenditure, Final Account: Preparation of Trading Account, Profit and Loss Account and Balance sheet, Final Account with Adjustment: Closing stock, outstanding expenses, prepaid expenses, Accrued Income, Provision for bad debt and Depreciation.

Course Outcomes:

CO-1: Interpret the process of accounting, uses and limitations.
CO-2: Identify the accounting concepts, principle and conventions.
CO-3: Solve, and examine the Journal Entries, Ledger, and Trial Balance.
CO-4: Prepare Financial Statements, Trading, Profit & Loss and Balance Sheet.

Reference Book:

1. Double Entry Book- Keeping, Juneja, Arora, Chawla, Kalyani
2. Financial Accounting, Maheshwari, Vikas
3. Financial Accounting Principle and Practices, Lal & Srivastava, S. CHAND

IMPC1002 FUNDAMENTALS OF IT (3-0-0)

Course Objectives:

The aim of this course is to:

1. Provide fundamental concepts and importance of Information Systems (IS) in modern business environments.

2. Provide knowledge of Database Management Systems (DBMS) and their role in data organization and management.
3. Explore the basics of Computer Networks, Internet Security, and their implications for business operations and data protection.
4. Learn about emerging trends in computing technologies and their applications in business and commerce.

Module - I:Information Systems for Business:
Need for Information Systems (IS), Business in the Information age, Information systems Concepts, Role of IT in various functional areas of business – Accounting & Finance, Marketing & Sales, Production & Logistics, and Human Resources Management Systems.

Module - III:Database Management Systems:
Database, Types of Databases, Components of a Database system. DBMS, DBMS language, Advantage and limitations of Database, Database models. Systems Planning - Traditional system development lifecycle (SDLC) - alternate methods for system development-dataflow analysis, System development outside the system.

Module-III: Basic Concepts of Computer Network &Internet Security:
Data Communication & Computer Network – Definition, Network Topologies Network Devices, Wireless Networking. Types of attacks, DOS attacks, Malicious Software, Hacking, Security Services, Security Mechanisms - Cryptography, Digital Signature, Firewall, Types of Firewalls, Identification& Authentication. ECommerce Overview- E-commerce Applications, M-Commerce Services & Applications, Emerging Trends in Computing.

Course Outcomes:
After completing the course, the students will be able to:
CO-1: Analyze and assess the role of information technology in diverse functional areas of business and its influence on strategic decision-making processes.
CO-2: Design and execute basic database management systems utilizing suitable database models and languages.
CO-3: Students will be able to evaluate network topologies, identify security threats, and apply appropriate security mechanisms to mitigate risks.
CO-4: Engage in discussions regarding emerging computing trends, including e-commerce applications, and their impacts on fostering business innovation and competitiveness.

Reference Books:
1. Foundations of Computing, 5th Edition, Sinha and Sinha, bpb publication
2. Management Information Systems: Managing the Digital Firm" by Kenneth C. Laudon and Jane P. Laudon
3. Database System Concepts, Seventh Edition by Avi Silberschatz, Henry F. Korth, S. Sudarshan, McGraw-Hill
4. Simplified Approach to DBMS By Parteek Bhatia Gurvinder Singh, Kalyani

IMPC1003 BASIC FINANCIAL ACCOUNTING - II (3-0-0)

Course Objectives:
1. To comprehend the significance of corporate accounting in financial reporting and management.

2. To master the processes involved in the issuance, management, and redemption of shares and debentures.
3. To apply advanced tools and techniques for financial statement analysis, including ratio analysis and cash flow statement evaluation.
4. To evaluate financial performance and make informed decisions based on comprehensive financial analysis.

Module-I: Accounting for Share Capital
Meaning and Importance of Corporate Accounting, Issue of shares, Payment in instalment, Journal entries for calls in Arrear and call-in advance, Forfeiture and Re-Issue of shares. Buyback of shares, understanding corporate Income statement and Balance sheet as presented in the Annual report of Companies.

Module-II: Accounting for Debentures
Issue of Debenture and Its classification, Different terms of issue of debenture, Redemption of debenture, Final accounts of limited liability companies as per the existing company Act, 2013 Contingency and events occurring after the balance sheet.

Module- III: Financial Statements analysis
Meaning, definition, objectives and uses of financial statement analysis, Tool or Techniques and Types of financial statementanalysis. Ratio analysis: Meaning, advantages and disadvantages, Types of ratios, Interpretation of ratio. Cash flow statement analysis, meaning, format, cash flow from operating activities, Investing Activities and Financing Activities (Indirect Method).

Course Outcomes:
CO-1: Demonstrate proficiency in recording transactions related to share capital, including installment payments, calls in arrears, and advanced calls.
CO-2: Apply knowledge of debenture issuance, classification, redemption, and compliance with regulatory requirements under the Companies Act, 2013.
CO-3: Utilize financial statement analysis tools and techniques to interpret corporate income statements, balance sheets, ratio analysis, and cash flow statements.
CO-4: Evaluate financial performance, liquidity, profitability, and solvency using advanced financial analysis methods, preparing them for roles in financial management and reporting.

Reference Book:
1. Double Entry Book-Keeping, Juneja, Arora, Chawla, Sahoo, Kalyani
2. Financial and Management Accounting, Satapathy & Sahoo, Vrinda
3. Financial Accounting and Analysis, Athma, HPH

IMPC1004 MARKETING MANAGEMENT - I (3-0-0)

Course Objective:
1. To sensitize the students to the dynamic nature of Marketing Management.
2. To expose students to a systematic frame work of marketing & implementations and to highlight need for different marketing approaches for services, goods, and for household consumers, organizational buyers.
3. To introduce the concept of Marketing Mix as a framework for Marketing Decision making.

4. The course is intended for defining and clarifying the concepts of marketing.

Module-I

Definition & Functions of Marketing:
Scope of Marketing, Core concepts of Marketing such as Need, Want, Demand, What can be marketed
Four Utilities of Marketing, Customer Perveived Value, Customer Satisfaction, Customer Delight, Customer Loyalty and types
Simple Marketing System, Modern Marketing System,

Evolution of Marketing concepts: Production, Product (with Marketing Myopia), Selling, Marketing and holistic
Understanding Markets: Potential market, Available market, Qualified available market, Target market, Penetrated market
Types of Market : B2B, B2C, B2G, Global, Not for Profit, Government, Marketplace, Marketsace, Metamarket,
Marketing v/s Market, Selling versus Marketing, Marketing Myopia. 80: 20 Principle, Bottom of the pyramid concept, Market Share, Market Size

Module-II

Concept of Marketing Environment: Need for analyzing the Marketing Environment. Macro and Micro environmental analysis or PESTEL analysis

STP concept -Segmentation: Definition, Need for segmentation, Benefits of segmentation to marketers, Criteria for effective segmentation,
Bases for market segmentation of consumer goods - Demographic, Geographic, Psychographic, Behavioural

Target Market: Concept of target market and criteria for selection of target market
Positioning: Concept of differentiation & positioning, Introduction to the concepts of Value Proposition, Point of Parity, Point of Difference or USP, Positioning errors.
Marketing Mix tools: 4Ps, 4As, 5Ps, 7Ps. Only concepts
Packaging &Labeling: Meaning & role of Packaging &Labeling.

Module-III

Understanding Consumer Behaviour:
Meaning & importance of Consumer behaviour, Difference between Customer and Consumer, Difference between Consumer buying behaviour and Organizational buying, Buyer roles , Factors affecting buying behaviour, Stages or Steps in consumer buying decision process, Buyer Black Box

Contemporary Topics (Concepts only) : Viral Marketing, Guerrilla Marketing, Ambush Marketing, Upselling and Cross selling, Societal and social Marketing, Relationship Marketing, Green Marketing , Digital Marketing, Network or Multi-level marketing, FOMO marketing, Customer Life Time Value

Course Outcomes:

CO-1: Identify the key analytical frameworks and tools used in marketing.
CO-2: Utilize the information of a firm's external and internal marketing environment to identify and prioritize appropriate marketing strategies.

CO-3: Design Segmentation, Targeting and Positioning strategies.
CO-4: Analyse different Buying Roles and interpret Consumer Buying Behaviour.

Text Books:
1. Marketing Management- A South Asian Perspective,13th Edition– Authors – Kotler, Keller, Koshy, Jha
2. Rajan Saxena, Marketing Management, TMH

Reference:
The above module has been prepared by referring to NPTEL Marketing Management-I Course by Prof. Jayanta Chatterjee and Prof. Shashi Shekhar Mishra | IIT Kanpur

IMPC1201 INFORMATION TECHNOLOGY LAB (0-0-2)

Course Objectives:
1. To know about the concept of Google Sheet and its Applications.
2. To know about the concept of DBMS/ RDBMS using MySQL / Oracle / Access.

Module - I
Introduction to Computer System, OS, Internet etc., Acquire the essentials for using & working with Google Services: Docs, Sheet, Presenter and Sites etc. Google Forms: Google's Form and Response sheet creation, in this section, you will learn how to send and receive forms through Google Drive so you can review them instantaneously. Google Mobile Apps: One of the greatest parts of using Google is its portability. This section shows you how to optimize the apps on your mobile device.Google Class Room: Learn about the Google Class Room, its use, importance, how teachers use it for assignments, mark etc.Google Calendar: Use of Google Calendar, how it is used, its importance etc.Google Sites: How to create site of your own using Google site, Over View of HTML, Design and importance of Web Design and Development.You Tube: Concept of You Tube, How to create You Tube Channel, Create short videos. Google Photo: Learn about the Google Photo, its use, importance, how teachers use it for editing photos, Uploading Photos etc.

Module - II
Introduction to DBMS / RDBMS using Oracle or MySQL, Learning Basic DML and DDL, Commands, Create, Alter, Truncate, View commands, Insert, Select, Delete, Update, Sort, Replace commands
N.B: All Computers must have Internet Connection and Assignments should design and developed by concerned faculty for students as per syllabus.

Course Outcomes:
CO-1: Create, Edit, Print and Share documents.
CO-2: Create, Edit, Print, Share and Present the Presentation.
CO-3: Apply the understanding of how various information & data representation in Spreadsheet.
CO-4: Outline the role of the Internet and ethical, social, & security issues of Internet Uses.

Text Books
- Google Apps for Dummies Karl Barksdale
- Learning Google Apps: Ramalingam Ganapathy
- Learning MySQL by Seyed M. M. Tahaghoghi

IMQT1001 BUSINESS STATISTICS (3-0-0)

Course Objectives:

1. To learn adequate theoretical; concept of statistics in various applied field in management decision making
2. To understand role of statistical tools in managerial decision making
3. To understand the applications of various quantitative techniques in managerial setting.

Module-I:

Statistics Introduction: Meaning and definitions of statistics; importance of statistics in business; limitations of statistics; types of data, collection of data; classification and tabulation of Data; graphic and diagrammatic presentation of Data. Measures of Central Tendency Introduction: The Arithmetic Mean; The Median: The Mode; comparison between mean, median and mode: The geometric Mean; The Harmonic Mean.

Module-II:

Measures of Dispersion: Introduction; The Range: The Quartile Deviation: The Mean Deviation; The Standard Deviation; Coefficient of Variation. Introduction, Skewness; Measures of Skewness; Moments; Kurtosis.

Module-III:

Probability,Introduction; Basic terminology in Probability; three types of Probability. Probability Axioms; Probability under conditions of statistical independence and dependence: Bayes' Theorem.

Course Outcomes:

CO-1: Collect, organize, and analyse data using appropriate statistical techniques and software tools.
CO-2: Demonstrate proficiency in descriptive statistics, including measures of central tendency, dispersion, and graphical representation of data.
CO-3: Build and evaluate predictive models using statistical methods, enabling them to forecast future trends, identify patterns, and make strategic decisions based on predictive analytics.
CO-4: Develop a solid understanding of probability theory and its applications in business contexts.

Books:

1. Statistics for Management - Lavin &Rubbin (TMH)
2. Statistical Methods and Quantitative Techniques- Digambar Patri (KP)

IMQT1002 QUANTITATIVE METHODS - I (3-0-0)

Course Objectives:

1. To learn adequate theoretical; concept of Quantitative techniques in various applied field in management decision making
2. To understand role of optimization techniques in managerial decision making
3. To understand the applications of various quantitative techniques in managerial setting.

Module-I:
Linear Programming:
Basic concept; Structure of Linear Programming Model; Application areas of Linear Programming. General Mathematical Model of Linear Programming Problem; Guidelines on Linear Programming Model Formulation; Examples of LP Model Formulation in various functional areas of management; Graphical Solution Method of LP Problems, The Simplex Method(Maximization Case; Minimization Case-Two Phase Method & Big M Method).

Module-II:
Transportation Problem:
Transportation Problem; Methods for Finding Initial Solution (North-West Comer Method, Least Cost Method, Vogel's Approximation); Test of Optimality- MODI Method Assignment Problem: Assignment Problem, Solution Methods of Assignment Problem- Hungarian Method for solving Assignment Problem; Variations in the Assignment Problem- Multiple Optimal solutions, Maximization Case in Assignment Problem, Unbalanced Assignment Problem, Restrictions on Assignments.

Module-III:
Decision Theory and Decision Tree:
Steps of Decision-making Process; Types of Decision Making Environment, Decision Making under Uncertainty (Optimism Criterion, Pessimism Criterion, Equal Probabilities criterion, Coefficient of Optimism Criterion, Regret Criterion); Decision Tree Analysis, Decision Making with Utilities.

Course Outcomes:
CO-1: Interpret Fundamental Concepts of Linear Programming.
CO-2: Evaluate and Solve Transportation Problems.
CO-3: Analyse and Solve Assignment Problems.
CO-4: Demonstrate Decision-Making Skills in Quantitative Environments.

Books:
1. Gupta & Hira, Operations Research, S.Chand.
2. Sharma,Operations Research, Macmillan

IMQT1201 ADVANCE EXCEL - LAB (0-0-2)

Course Objectives:
1. To master fundamental Excel functionalities including data entry, formatting, and basic formula usage.
2. To develop proficiency in advanced Excel features such as conditional formatting, data manipulation, and table creation.
3. To acquire skills in utilizing Excel shortcuts, functions, and data analysis techniques.
4. To gain an understanding of data visualization principles and practical applications within Excel.

Module - I
Introduction to Excel, Advance Excel, Data & Information. Excel Variables, Difference between DBMS and Excel Workbook. Creating, Entering, Editing and Formatting Data, Basic & Conditional Formatting Data, Managing Worksheets, Modifying Rows and Columns, Understanding Formulas and Functions, Changing Views, Data Freezing,

Merging, Custom Fills, AutoFill and Flash Fill, Use of Format Painter, Shapes. Creating Tables and Difference between Table and sheet Data.

Module - II

Excel Shortcuts, Copy, Paste and Paste Special options. Cell, Cell naming and Cell Referencing, Types of reference in Excel, Ranges and Dates, Difference between Formula and Function, Types of Function, Use of Text Functions. Use of Mathematic and Statistics functions Searching, Sorting, Filtering Data, Data Counting, Conditional Logic using If and Nested If, Difference between Total and Subtotals, Advance Data Filtering, Use of What-If Analysis, Data Ammonization in Excel, Data Validation, Data Protection, Introduction to Data Visualization, Visualize simple data and conditional data, Use of Look ups in Excel.

Course Outcomes:

CO-1: Demonstrate proficiency in Excel for data entry, formatting, and basic formula manipulation.

CO-2: Apply advanced Excel features including conditional formatting, data filtering, and table creation to manage and analyze data effectively.

CO-3: Utilize Excel shortcuts, functions, and data analysis techniques to streamline workflows and make informed decisions.

CO-4: Create visually appealing and informative data visualizations using Excel's visualization tools and functions.

Text Books:

- Microsoft Excel All in one by Greg Harvey
- Microsoft Excel Quick Start Guide for Beginners by William Fischer

SYLLABUS

FOR

FIRST YEAR

MCA PROGRAMME

(Effective from 2024-25)

2024-25

BIJU PATNAIK UNIVERSITY OF TECHNOLOGY, ODISHA

ROURKELA

COURSE STRUCTURE

FIRST SEMESTER

Category	Subject Code	Subject	L-T-P	Credit	University Marks	Internal Marks
THEORY						
1. BS	MCBS1001	Discrete Mathematics	3-0-0	3	100	50
2. PC	MCPC1001	Digital Logic Design	3-0-0	3	100	50
3. PC	MCPC1002	Computer Networks	3-0-0	3	100	50
4. PC	MCPC1003	Programming for Problem Solving	3-0-0	3	100	50
5. PC	MCPC1004	Database Management Systems	3-0-0	3	100	50
6. HS	MCHS1001	Communicative English	2-0-0	2	100	50
	Total		**17-0-0**	**17**	**600**	**300**
SESSIONAL / PRACTICAL						
7. PC	MCPC1201	Computer Networks Lab.	0-0-3	1.5	-	100
8. PC	MCPC1202	C Programming Lab	0-0-3	1.5	-	100
9. PC	MCPC1203	Database Management Systems Lab	0-0-3	1.5	-	100
10. HS	MCHS1201	Language Lab	0-0-3	1.5	-	100
		Total	**17-0-12**	**06**	**-**	**400**
		Total Semester		**23**	**600**	**700**
		Grand Total (Theory + Practical) = 1300				

SECOND SEMESTER

Category	Subject Code	Subject	L-T-P	Credit	University Marks	Internal Marks
THEORY						
1. PC	MCPC1005	Object-Oriented Programming using JAVA	3-0-0	3	100	50
2. PC	MCPC1006	Software Engineering	3-0-0	3	100	50
3. PC	MCPC1007	Data Structures	3-0-0	3	100	50
4. PC	MCPC1008	Computer Organization and Architecture	3-0-0	3	100	50
5. PC	MCPC1009	Theory of Computation	3-0-0	3	100	50
6. HS	MCHS1002	Universal Human Values & Professional Ethics	2-0-0	2	100	50
	Total		**17-0-0**	**17**	**600**	**300**
SESSIONAL / PRACTICAL						
7. PC	MCPC1204	Object-Oriented Programming Lab	0-0-3	1.5	-	100
8. PC	MCPC1205	Software Engineering Lab	0-0-3	1.5	-	100
9. PC	MCPC1206	Data Structures Lab	0-0-3	1.5	-	100
10. PC	MCPC1207	Programming in Python Lab	0-0-3	1.5	-	100
		Total	**17-0-12**	**06**	**-**	**400**
		Total Semester		**23**	**600**	**700**
		Grand Total (Theory + Practical) = 1300				

MCBS1001 DISCRETE MATHEMATICS (3-0-0)

Course Objectives:

1. To learn the mathematical foundations required for computer science.
2. This course will help in understanding other courses in computer science.

Learning Outcomes:

Upon completion of this course, students will be able to:

CO1 : Define & describe various logical connectives and expressions along with rules of inferences.
CO2 : Apply various methods of proofs and proof strategies.
CO3 : Learn the concepts of function and develop the various algorithms and its complexity.
CO4 : Model counting techniques using recurrence relations & generating functions for applications.
CO5 : Develop the concepts and applications of graphs in various computer science problems

Module 1:

Logic and Proofs: Propositional logic, Propositional Equivalences, Predicates and Quantifiers, Nested Quantifiers, Rules of Inference, Introduction to Proofs. Sets: Venn Diagrams, Subsets, The size of a set, Power Sets, Cartesian Products, Set Operations.

Module 2:

Functions: One-to-One and Onto Functions, Inverse Functions and Compositions of Functions Partial Functions. Sequences and Summations. Algorithms, Searching Algorithms: Linear Search, Binary Search, Sorting: Bubble Sort, Insertion Sort, The Growth of Functions, Complexity of Algorithms.

Module 3:

Counting: The Basics of Counting, The Pigeonhole Principle, Permutations and Combinations, Binomial Coefficients, Recurrence Relations.

Relations: Relations and their Properties, n-ary Relations and their Applications, Representing Relations, Closure of Relations, Equivalence Relations, Partial Orderings.

Module 4:

Graphs: Graph Terminology and Special Types of Graphs, Bipartite Graphs, Representing Graphs: Isomorphism of Graphs, Euler and Hamilton Paths, Shortest Path Problems: Dijkstra's Algorithm, Traveling Salesperson Problem, Planar Graphs, Graph Coloring. Trees: Tree Traversal, Minimum Spanning Trees.

Text Books:

1. Kenneth H. Rosen, Discrete Mathematics and its Applications, Mc Graw Hills International Seventh Edition.
2. C. L. Liu, "Elements of Discrete Mathematics", McGraw Hills International Second Edition.

Reference Books:

1. Elements of Discrete Mathematics by C. L. Liu and D.P. Mohapatra, TMH, 2012
2. J. P Tremblay, R. Manohar, "Discrete Mathematical Structures with Applications to Computer Science", TMH, 1997.

MCHS1001 COMMUNICATIVE ENGLISH (2-0-0)

Course Objectives:

This course is designed to enhance the communication skills of MCA students, focusing on the specific needs of computer science professionals. The syllabus aims to develop proficiency in English for academic, professional, and everyday use.

Course Outcomes:

CO1: Students will be able to articulate the basic principles and processes of communication, identify and overcome common barriers, and distinguish between verbal and non-verbal communication methods.

CO2: Students will demonstrate improved listening skills through active listening techniques, effective comprehension, and the ability to engage in clear and confident public speaking, group discussions, and role plays.

CO3: Students will develop proficiency in writing professional documents including emails, memos, business letters, and technical reports, ensuring proper format, etiquette, and avoidance of plagiarism.

CO4: Students will be capable of preparing and delivering effective presentations using appropriate visual aids and tools, while also demonstrating a strong grasp of English grammar including state and event verbs, tense and aspect, and subject-verb agreement.

CO5: Students will understand the dynamics of interpersonal communication, the importance of workplace ethics, and cross-cultural communication. They will also learn to effectively communicate within teams, understand roles and responsibilities, and utilize collaborative tools and technologies.

CO6: Students will enhance their reading comprehension and critical analysis skills for both technical and non-technical texts, expand their vocabulary with strategies for learning new words and technical terms, and develop skills for writing effective blogs, social media posts, and website content.

Module 1: BASICS OF COMMUNICATION

1. Introduction to Communication: Definition and Process; Types of Communication: Verbal and Non-verbal; Barriers to Effective Communication
2. Listening Skills: Active Listening Techniques; Barriers to Effective Listening; Listening Comprehension Exercises
3. Speaking Skills: Basics of Pronunciation and Intonation; Public Speaking: Techniques and Practice; Group Discussions and Role Plays

Module 2: PROFESSIONAL COMMUNICATION

1. Business Writing: Email Writing: Format and Etiquette; Writing Memos and Notices; Business Letters: Inquiry, Complaint, and Job Application Letters; Writing Technical Reports; Avoiding Plagiarism
2. Presentation Skills: Preparing Effective Presentations; Visual Aids: Use of PowerPoint and Other Tools; Delivering Presentations with Confidence
3. Basics of English Grammar: State and Event Verbs; Tense and Aspect; Subject-Verb Agreement

Module 3: INTERPERSONAL SKILLS

1. Interpersonal Communication: Building Relationships through Communication; Importance of Ethics at the Workplace; Cross-Cultural Communication
2. Teamwork and Collaboration: Effective Team Communication; Roles and Responsibilities in a Team; Collaborative Tools and Technologies
3. Interview Skills: Preparing for an Interview; Common Interview Questions and Answers; Mock Interviews and Feedback

Module 4: ENHANCING LANGUAGE SKILLS

1. Reading Comprehension: Techniques for Effective Reading; Critical Reading and Analysis; Reading Technical and Non-Technical Texts
2. Vocabulary Building: Strategies for Learning New Words; Using Context Clues; Technical Vocabulary for Computer Science
3. Writing for the Web: Writing Blogs and Articles; Social Media Communication; Writing Content for Websites

TEXTBOOKS:

1. "Technical Communication" by Mike Markel
2. "English for Technical Communication" by Aysha Viswamohan
3. "Effective Technical Communication " by M Ashraf Rizvi

MCHS1201 LANGUAGE LAB (0-0-3)

These lab experiments aim to provide practical, hands-on experience in various aspects of communicative English, tailored to the needs of MCA students.

List of Experiments:

Module 1: BASICS OF COMMUNICATION

Experiment 1: Communication Role Play
Objective: Understand verbal and non-verbal communication.
Activities:

1. Role-play different scenarios (e.g., a business meeting, a social gathering) focusing on body language, gestures, and spoken words.
2. Identify and discuss the barriers encountered.

Experiment 2: Active Listening Exercises
Objective: Enhance listening skills.
Activities:

1. Listen to a recorded speech and answer comprehension questions.
2. Engage in a paired listening activity where one student speaks and the other practices active listening, followed by feedback.

Module 2: PROFESSIONAL COMMUNICATION

Experiment 3: Email Writing Practice
Objective: Develop proficiency in writing professional emails.
Activities:

1. Write emails for different purposes (e.g., inquiry, complaint).
2. Peer review and discuss the format, tone, and etiquette of each email.

Experiment 4: Presentation Preparation and Delivery
Objective: Improve presentation skills.
Activities:
1. Prepare a PowerPoint presentation on a technical topic.
2. Deliver the presentation to the class, focusing on clarity, confidence, and use of visual aids. Receive and give constructive feedback.

Module 3: INTERPERSONAL SKILLS
Experiment 5: Team Communication Simulation
Objective: Enhance teamwork and collaboration skills.
Activities:
1. Engage in a group project simulation where roles and responsibilities are assigned.
2. Use collaborative tools (e.g., Google Docs) to work together and present findings.

Experiment 6: Mock Interviews
Objective: Prepare for job interviews.
Activities:
1. Participate in mock interviews with common interview questions.
2. Receive feedback on responses, body language, and overall performance from peers and instructor.

Module 4: ENHANCING LANGUAGE SKILLS
Experiment 7: Critical Reading Analysis
Objective: Improve critical reading skills.
Activities:
1. Read a technical article and identify key points, arguments, and conclusions.
2. Discuss the article in groups, focusing on analysis and interpretation.

Experiment 8: Vocabulary Building Exercises
Objective: Expand vocabulary.
Activities:
1. Use context clues to understand and define new technical terms from computer science texts.
2. Create flashcards for new vocabulary and engage in peer quizzes.

Experiment 9: Writing a Technical Blog
Objective: Develop web writing skills.
Activities:
1. Write a blog post on a recent technological advancement or trend.
2. Peers review the posts focusing on clarity, conciseness, and engagement.

Experiment 10: Social Media Communication
Objective: Practice concise and effective writing for social media.
Activities:
1. Create social media posts (e.g., tweets, LinkedIn updates) about a technical topic.
2. Discuss the effectiveness and engagement of each post, considering the target audience.

MCPC1001 DIGITAL LOGIC DESIGN (3-0-0)

Course Objectives:

1. To introduce the fundamental concepts of digital logic and Boolean algebra.
2. To develop and understanding of combinational and sequential logic circuits.
3. To explore advanced topics such as memory elements, state machines, and programmable logic devices.

Course Outcomes: Upon successful completion of this course, students should be able to:

CO1 : Analyze and design combinational logic circuits using Boolean algebra and Karnaugh maps.
CO2 : Design and implement sequential logic circuits, including flip-flops, counters, and registers.
CO3 : Apply knowledge of digital logic to solve real-world engineering problems.

Module 1:
Binary Systems: Digital Computers and Digital Systems, Binary Numbers, Number Base Conversions, Octal and Hexadecimal Numbers, Complements, Signed Binary Numbers, Boolean Algebra and Logic Gates: Boolean functions, Logic Operators, digital Logic Gates, Simplification of Boolean functions: Two and Three Variable Maps, Four Variable Map, Five Variable Map, Product of Sums Simplification, NAND and NOR Implementation, Don't Care Conditions.

Module 2:
Combinational Logic: Design Procedure, Adders, Subtractors, Code Conversion, Analysis Procedure, Multilevel NAND Circuits, Multilevel NOR Circuits, Exclusive OR Functions, Binary Adder and Subtractor, Decimal Adder, Magnitude Comparator, Decoders and Encoders, Multiplexers, Programmable Logic Array (PLA), Programmable Array Logic (PAL).

Module 3:
Flip-Flops: RS Flip-Flop, D Flip-Flop, JK and T Flip-Flops, Triggering of Flip-Flops, Analysis of Clocked Sequential Circuits, State Reduction and Assignment, Design Procedure, Design of Counters, Registers, Shift Register, Ripple Counters, Synchronous Counters, Timing Sequences, Random-Access Memory (RAM)

Module 4:
Semiconductor RAM Memories: Internal Organization of Memory Chips, Static Memories, Dynamic RAMs, Read-only Memories: ROM, PROM, EPROM, EEPROM, Flash Memory, Direct Memory Access, Memory Hierarchy, Cache Memory, Virtual Memory, Secondary Storage: Magnetic Hard Disks, Optical Disks, Magnetic Tape Systems
Memory elements: SRAM, DRAM, ROM, Programmable logic arrays (PLAs) and field-programmable gate arrays (FPGAs), Introduction to hardware description languages (HDLs) such as Verilog or VHDL, Introduction to digital simulation tools

Text Books:

1. "Digital Design" by M. Morris Mano and Michael D. Ciletti
2. "Fundamentals of Digital Logic with Verilog Design" by Stephen Brown and Zvonko Vranesic
3. "Computer Organisation and Embedded Systems" by Carl Hamacher, Z Vranesic, S Zaky and N Manjikian

Reference Books:

1. "Digital Systems: Principles and Applications" by Ronald J. Tocci, Neal S. Widmer, and Greg Moss
2. "Introduction to Logic Design" by Alan B. Marcovitz

MCPC1002 COMPUTER NETWORKS (3-0-0)

Objective :

1. Introduce students to the architecture, standards, and protocols of computer networks.
2. Provide an understanding of the functionalities of various network layers, including physical, data link, network, transport, and application layers.
3. Discuss the principles of routing, addressing, and internetworking in modern network environments.
4. Familiarize students with network applications, standard protocols, and techniques for ensuring quality of service and congestion control.

Module-I

Overview of the Internet: introduction to data communication, network application, Network hardware, Protocol, Layering Scenario, reference models: The OSI Model, TCP/ IP model, Internet history, standards and administration; Comparison of the OSI and TCP/ IP reference model. Physical Layer: data and signals: analog and digital, periodic analog signals, digital signals, transmission impairments, data rate limit, Guided transmission media, unguided transmission media, Wireless transmission, mobile telephone system.

Module–II

Data Link Layer: Design issues, error detection and correction design issues, elementary data link protocols, CRC codes, sliding window protocols, HDLC, the data link layer in the internet. Elementary Data Link Layer Protocols, sliding window protocols, noisy and noiseless channels.

THE MEDIUM ACCESS SUBLAYER: Channel allocations problem, multiple access protocols, Ethernet, Data Link Layer switching, Wireless LAN, Broadband Wireless, Bluetooth.

Module–III

Connecting devices: learning bridges, spanning tree bridges, repeaters, hubs, bridges, switches, routers and gateways, definition of multiplexing and types.

Network Layer: Network Layer Design issues, store and forward packet switching, connectionless and connection oriented networks-routing algorithms-optimality principle, circuit and packet switching, definition of flooding and multicast.

Module– IV

Routing protocols: Shortest Path, Routing uni-cast Distance Vector Routing, RIP, link state protocols, path vector routing. Internetworking: logical addressing, internet protocols, IP address, CIDR, IPv4 addressing, IPv6 Protocol addressing, addresses mapping, ICMP, IGMP,ARP,RARP, DHCP.

Module-V

Transport Protocols: process to process delivery, UDP, TCP, TCP Sliding Window, TCP Congestion Control, congestion control and quality of service.

Application Layer-World Wide Web, Standard client-server application-HTTP, FTP, electronic mail, TELNET, DNS.

Course Outcome :

Upon successful completion of this course, students will be able to:

1. Explain the architecture and functioning of different network layers and their associated protocols.
2. Compare the OSI and TCP/IP reference models and understand their application in real-world networks.
3. Implement and troubleshoot data link layer protocols and error detection/correction methods.
4. Design and manage network systems using appropriate hardware and software tools, including IP addressing and routing protocols.
5. Utilize and manage network applications and protocols such as HTTP, FTP, email, TELNET, and DNS effectively.

Text Books :

1. "Computer Networking: A Top-Down Approach" by James F. Kurose and Keith W. Ross.
2. "Data Communications and Networking" by Behrouz A. Forouzan.

References :

1. Computer networks by Tanenbaum, A.S., Pearson Education India.
2. Computer Networks by Bhushan Trivedi, Oxford University Press

MCPC1003 PROGRAMMING FOR PROBLEM SOLVING (3-0-0)

Course Objectives:

1. To provide an understanding of basic programming concepts using the C programming language.
2. To develop problem-solving skills using C programming constructs.
3. To introduce students to algorithmic thinking and program design techniques.
4. To enable students to write, compile, and debug programs in C.

Course Outcomes (CO):

CO1: Understand the fundamental concepts of programming using the C language.
CO2: Develop problem-solving skills through the application of programming constructs in C.
CO3: Design and implement functions and algorithms to solve complex problems.
CO4: Demonstrate proficiency in using pointers, arrays, and structures in C programming.
CO5: Apply error handling and debugging techniques to identify and resolve programming errors.
CO6: Utilize file handling mechanisms in C for input/output operations.
CO7: Appreciate the importance of data structures and their implementation in C.

Module 1: Introduction to C Programming

Introduction to Problem Solving through programs, Flowcharts/Pseudo codes, the compilation process, Syntax and Semantic errors, Variables and Data Types , Arithmetic expressions, Relational Operations, Logical expressions; Conditional Branching and Iterative Loops.

Module 2: Functions and Arrays
Introduction to Functions, Function Prototypes and Declarations, Parameter Passing in Functions, Recursion, Arrays: 2-D arrays, Character Arrays and Strings.

Module 3: Pointers and Structures
Introduction to Pointers, Pointer Arithmetic, Dynamic Memory Allocation, Structures and Unions
File Handling in C, Self-Referential Structures and Introduction to Lists.

Module 4: Advanced Concepts in C
Preprocessor Directives, Command Line Arguments, Bitwise Operators, Error Handling and Debugging Techniques, Introduction to Data Structures in C.

Textbooks:
1. Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill
2. E. Balaguruswamy, Programming in ANSI C, Tata McGraw-Hill

Reference Books:
1. "C Programming: A Modern Approach" by K.N. King
2. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice Hall of India
3. "Let Us C" by Yashavant Kanetkar
4. "Programming in C" by Stephen G. Kochan

MCPC1004 DATABASE MANAGEMENT SYSTEMS (3-0-0)

Course Objective:
This course provides fundamental and practical knowledge on database concepts by means of organizing the information, storing and retrieve the information in an efficient and a flexible way from a well-structured relational model. This course ensures that every student will gain experience in creating data models and database design and be able to do the followings.

Focus the role of a database management system in an organization and construct ER Diagram.
Demonstrate basic database concepts, including the structure and operation of the relational data model and basic database queries using SQL.
Applying advanced database queries using Structured Query Language (SQL).
Evaluating logical database design principles and database normalization.
Demonstrate the concept of a database transaction, concurrency control, and data object locking and protocols.

Course Outcomes:
After successful completion of the course the student will be able to:
CO1: Understand database design principles.
CO2: Apply data Modelling using E-R diagrams.
CO3: Create refined data models using normalization.
CO4: Build database queries using Structured Query Language.
CO5: Understand the transaction management and concurrency control.

Module– 1

Introduction to DBMS: File system vs. DBMS, advantages of DBMS, storage data, queries, DBMS structure, Types of Databases – Hierarchical, Network, Relational, Key-Value, Object Oriented, XML DB Overview of File Structures in database, 3-schema architecture of DBMS, data independence, EF Codd Rule.

Module– 2

Data base Design: Data models, the importance of data models. E-R model: Entities, attributes and entity sets, relationship and relationship set, mapping cardinalities, keys, features of ER model, conceptual database design with ER model.

Relational model: Integrity constraints over relations and enforcement, querying relation data, logical database design, views, destroying/altering tables and views, Relational algebra, Extended relational algebra Operations.

Module- 3

Schema Refinement and Normal Forms: Introduction to Schema Refinement, Functional Dependencies, Reasoning about Functional Dependencies. Normal Forms, Properties of Decomposition, Normalization, different types of dependencies.

Module– 4

Basic SQL: Introduction to SQL, Basic SQL Queries: DML, DDL, DCL, and TCL

Structured Query Language (SQL): Select Commands, Union, Intersection, Except, Nested Queries, Aggregate Operators, Null values, Relational set operators, SQL join operators

Relational Algebra (RA): Selection, Projection, Set operations, joins

Relational Calculus (TRC, DRC): Tuple Relational Calculus, Domain Relational Calculus PL/SQL, Assertions, Triggers. Introduction to Transaction Management: ACID properties, Transactions and Schedules, Concurrent Execution of Transactions, Lock-Based Concurrency Control. Concurrency Control: 2PL, Serializability and Recoverability, Introduction to Lock Management, Lock Conversions, Dealing with Deadlocks, Concurrency control without locking. Crash Recovery: Aries, Recovering from a System Crash.

Advanced Database: OODB, WEB based DB, Data warehousing and Data mining.

Textbooks:

1. H.F. Korth, A. Silverschatz, Abraham," Database system concepts", Tata McGraw Hill Publication, 6e, 2011
2. Raghu Ramakrishna and Johannes Gehrke, Database Management Systems, McGraw-Hill, 3e, 2014

References:

1. D. Ullman, Principles of Database and Knowledge – Base Systems, Vol. 1, 1/e, Computer Science Press, 1990.
2. Ramez Elmasri, Shamkant B. Navathe, Fundamentals of Database Systems, Pearson Education, 7e, 2016.
3. Er. Rajiv chopra, "Database management systems, A Practical Approach", S. Chand Publishing

MCPC1201 COMPUTER NETWORKS LABORATORY (0-0-3)

Objective:
The Computer Networks Laboratory course aims to provide hands-on experience with the principles and practice of computer networks, focusing on both the theoretical and practical aspects of network design, implementation, and troubleshooting.

Course Outcomes:
By the end of the course, students will be able to:
1. Understand and implement various networking protocols.
2. Configure and troubleshoot network devices.
3. Analyze network performance.
4. Design and implement small-scale networks.

Laboratory Sessions:
1. Introduction to Network Lab Tools:
   - Overview of network simulation tools like Cisco Packet Tracer, GNS3, Wireshark.
   - Introduction to basic networking commands (ping, tracert, ipconfig/ ifconfig).
2. Basic Network Configuration:
   - Setting up a simple peer-to-peer network.
   - Configuring IP addresses and subnet masks.
   - Testing network connectivity using ping and tracert.
3. Error Detection and Correction:
   - Implementing CRC error detection.
   - Simulating error correction mechanisms.
4. Elementary Data Link Protocols:
   - Simulation of sliding window protocols.
   - Analysis of protocol performance over noisy and noiseless channels.
5. Medium Access Control:
   - Configuring and analyzing Ethernet networks.
   - Setting up and testing Wireless LAN (WLAN) connections.
   - Exploring Bluetooth network configurations.
6. Network Devices Configuration:
   - Setting up and configuring switches, routers, and gateways.
   - Understanding the use of repeaters, hubs, and bridges in a network.
7. Multiplexing Techniques:
   - Implementing and analyzing different types of multiplexing (TDM, FDM).
8. Routing Algorithms:
   - Implementing and analyzing shortest path routing algorithms.
   - Configuring Distance Vector Routing (RIP) and Link State Routing (OSPF).
9. IP Addressing and Subnetting:
   - Configuring IPv4 and IPv6 addressing.
   - Subnetting practice and exercises.
10. Address Mapping Protocols:
    - Implementing and analyzing ARP, RARP, ICMP, IGMP.
    - Configuring and testing DHCP.

11. Transport Layer Protocols:
    - o Simulation and analysis of TCP and UDP.
    - o Configuring TCP sliding window and congestion control mechanisms.
12. Quality of Service (QoS):
    - o Implementing and analyzing QoS in networks.
    - o Configuring QoS settings on network devices.
13. Application Layer Protocols:
    - o Setting up and testing HTTP, FTP, and DNS.
    - o Configuring and analyzing email protocols (SMTP, POP3, IMAP).
    - o Exploring TELNET and SSH for remote connectivity.

Reference Material:

- "Computer Networking: A Top-Down Approach" by James F. Kurose and Keith W. Ross.
- "Data Communications and Networking" by Behrouz A. Forouzan.
- Cisco Packet Tracer and GNS3 Documentation.

MCPC1202 C PROGRAMMING LAB (0-0-3)

List of Experiments:

1. Simple C programs.
2. Using If and switch constructs programs
3. Looping related problems
4. Programs using functions
5. If statement, If..else statement, nesting if else statement, else if ladder, switch statement, goto statement, while
6. statement, do statement, for statement
7. One-dimensional arrays, two dimensional arrays, multi dimensional arrays
8. Initialization of string variables, reading and writing strings, string handling functions
9. Programs using structures
10. Programs using unions
11. Initialization of pointer variables, address of variable, accessing a variable through its pointer
12. Pointer as Functions
13. Strings with Pointer: pointers and character strings, pointers and structures
14. Programs based on file handling
15. Command Line Arguments
16. Error Handling

MCPC1203 DATABASE MANAGEMENT SYSTEMS LAB (0-0-3)

List of Experiments:

1. Execute a single line and group functions for a table.
2. Execute DCL and TCL Commands.
3. Implement the query in SQL for a) insertion b) retrieval c) updating d) deletion.
4. Using Joins, Index, Key constraints and Normalization
5. Create views, partitions and locks for a particular DB
6. Write PL/SQL procedure for an application using exception handling
7. Write PL/SQL procedure for an application using cursors.

8. Write a DBMS program to prepare reports for an application using functions.
9. Write a PL/SQL block for transaction operations of a typical application using triggers.
10. Write a PL/SQL block for transaction operations of a typical application using package.
11. Design and develop an application using any front end and back end tool (make use of ER diagram and DFD).
12. Writing Assertion
13. Implementing operation on relation using PL/SQL
14. Creating Forms
15. Generating Reports

MCPC1005 OBJECT ORIENTED PROGRAMMING USING JAVA (3-0-0)

Course Objectives:

- To provide an understanding of basic programming concepts using the Java programming language.
- To develop problem-solving skills using Java programming constructs.
- To introduce students to algorithmic thinking and program design techniques and enable students to write, compile, and debug programs in Java.

Course Outcomes (CO):

CO1: Understand the fundamental concepts of programming using the Java language.
CO2: Develop problem-solving skills through the application of programming constructs in Java and design & implement functions and algorithms to solve complex problems.
CO3: Demonstrate proficiency in using pointers, arrays, and structures in Java programming.
CO4: Apply error handling and debugging techniques to identify and resolve programming errors.
CO5: Utilize file handling mechanisms in Java for input/output operations and appreciate the importance of data structures and their implementation in Java.

Module-I

JAVA BASICS: Review of Object-oriented concepts, History of Java, Java buzzwords, JVM architecture, Data types, Variables, Scope and life time of variables, arrays, operators, control statements, type conversion and casting, simple java program, constructors, methods, Static block, Static Data, Static Method String and String Buffer Classes, Using Java API Document.

Module-II

INHERITANCE AND POLYMORPHISM: Basic concepts, Types of inheritance, Member access rules, Usage of this and Super key word, Method Overloading, Method overriding, Abstract classes, Dynamic method dispatch, Usage of final keyword. PACKAGES AND INTERFACES: Defining package, Access protection, importing packages, Defining and Implementing interfaces, and Extending interfaces. I / O STREAMS: Concepts of streams, Stream classes- Byte and Character stream, Reading console Input and Writing Console output, File Handling.

Module-III
EXCEPTION HANDLING: Exception types, Usage of Try, Catch, Throw, Throws and Finally keywords, Built-in Exceptions, Creating own Exception classes. MULTI THREADING: Concepts of Thread, Thread life cycle, creating threads using Thread class and Runnable interface, Synchronization, Thread priorities, Inter Thread communication. AWT CONTROLS: The AWT class hierarchy, user interface components- Labels, Button, Text Components, Check Box, Check Box Group, Choice, List Box, Panels – Scroll Pane, Menu, Scroll Bar. Working with Frame class, Colour, Fonts and layout managers.

Module-IV
EVENT HANDLING: Events, Event sources, Event Listeners, Event Delegation Model (EDM), Handling Mouse and Keyboard Events, Adapter classes, Inner classes. SWINGS: Introduction to Swings, Hierarchy of swing components. Containers, Top level containers -JFrame, JWindow, JDialog, JPanel, JButton, JToggleButton, JCheckBox, JRadioButton, JLabel,JTextField, JTextArea, JList, JComboBox, JScrollPane. APPLETS: Life cycle of an Applet, Differences between Applets and Applications, Developing applets, simple applet.

Books:

1. Herbert schildt (2010), The complete reference, 7th edition, Tata Mc graw Hill, New Delhi
2. Programming with Java, E. Balagurusamy, McGraw-Hill Education, 6th Edition.
3. Head First Java, O'rielly publications 2. T. Budd (2009), An Introduction to Object Oriented Programming, 3rd edition, Pearson Education, India.
4. J. Nino, F. A. Hosch (2002), An Introduction to programming and OO design using Java, John Wiley & sons, New Jersey.
5. Y. Daniel Liang (2010), Introduction to Java programming, 7th edition, Pearson education, India.

MCPC1006 SOFTWARE ENGINEERING (3-0-0)

Objectives:
- To provide the idea of decomposing the given problem into Analysis, Design, Implementation, Testing and Maintenance phases.
- To provide an idea of using various process models in the software industry according to given circumstances.
- To gain the knowledge of how Analysis, Design, Implementation, Testing and Maintenance processes are conducted in a software project.

Course Outcomes(CO):
CO1: Students will be able to decompose the given project in various phases of a lifecycle.
CO2: Students will be able to choose appropriate process model depending on the user requirements.
CO3: Students will be able perform various life cycle activities like Analysis, Design, Implementation, Testing and Maintenance.
CO4: Students will be able to know various processes used in all the phases of the product.
CO5: Students can apply the knowledge, techniques and skills in the development of a software product.

Module-I
Introduction to Software Engineering: The evolving role of software, Changing Nature of Software. A Generic view of process: Software engineering- A layered technology, a process framework, Process patterns, process assessment, personal and team process models. Process models: The waterfall model, Incremental process models, Evolutionary process models, spiral, specialized process models, The Unified process.

Module-II
Requirement analysis: problems in information elicitation, methods of eliciting user requirements, functional and non-functional requirements, tools for requirement analysis, document flow charts, decision tables, data flow diagrams, data dictionaries, tools for analyzing real time systems, Use case diagrams, system sequence diagrams, CRC card, software requirement specification.

Software Requirements: Functional and non-functional requirements, User requirements, System requirements, the software requirements document. Requirements engineering process: Feasibility studies, Requirements elicitation and analysis, Requirements validation, Requirements management, software requirement specification.

Module-III
Software design: The design process, Function-oriented design, Data base oriented design, Object oriented design, Data base design. Coding: Code documentation, data declaration, statement construction, guidelines for input/output, efficiency with regard to code, memory and input/output.

Module-IV
Testing: Unit testing, black box and white box testing, test cases, integration testing, top-down and bottom-up testing, validation testing, alpha and beta testing, system testing. Maintenance: software reliability, availability, and maintainability, Reliability models. Risk management: software risks, Risk identification, Risk projection, Risk refinement, Quality Management: Quality concepts, Software quality assurance, Software reliability, The ISO 9000 quality standards.

Books
1. Software Engineering: A Practitioners Approach by Roger Pressman, 6th Edition, McGraw-Hill
2. Software Engineering by Ian Sommerville, Addison-Wesley
3. Fundamentals of Software Engineering by Rajiv Mall, PHI

MCPC1007 DATA STRUCTURES (3-0-0)

Objectives:
- Course objectives reflect specific knowledge, skills, abilities, or competencies that instructors expect students to acquire from a particular course.
- Course objectives are often very specific and detailed statements that describe the content or skills that will be taught in the classroom.
- In some regards, course objectives can be thought of as inputs of student learning, representing the many important details that faculty members will cover during a particular course.

Course Outcomes(CO):

After successful completion of the course the student will be able to:

CO1: To understand the role and application of Data Structure in real life.

CO2: To develop abstract data types for solving the complex problems.

CO3: To understand the concepts of non-linear data structure and application.

CO4: To analyze the efficiency of algorithms.

CO5: To describe the concept of Graph Theory in detail.

Module-I

Fundamentals: Introduction to Data Structures, Classification of Data Structures, Algorithms, Measuring Space and Time Complexities, Asymptotic Notations, Abstract Data Types.

Arrays: Storage Structures for Arrays, Sparse Matrixes, Strings, Pattern Matching.

Linked Lists: Dynamic Memory Management, Single Linked Lists, Double Linked Lists, Circular Linked Lists, Operations on Polynomials.

Stacks and Queues: Representation, Linked Stacks and Queues, Operations on Stacks and Queues, Applications of Stack and Queues.

Module-II

Trees: Terminology, Representation, Binary Trees, Binary Search Trees, Searching, Insertion and Deletions Operations in a Binary Search Tree, Height Balanced Trees, M-way Search Trees, B-Trees, B+ Trees, General Trees, Representation of General Trees and Binary Trees, Forests, Application of Trees.

Module-III

Graphs: Terminology, Representation, Path Matrix, Graph Traversal, Shortest Path Problems, Topological Sort.

Searching and Sorting Techniques: Linear and Binary Search, Bubble Sort, Insertion Sort, Selection Sort, Quick Sort, Merge Sort, Heap and Heap Sort, Radix Sort, Comparison of Sorting Techniques.

Module-IV

Hashing: Hash Functions and Hashing Techniques. External sorting, Implementation using programming in C.

Books:

1. Data Structures Using C - Aaron M. Tenenbaum
2. Tremblay, Jean-Paul, and Paul G. Sorenson, "An introduction to data structures with applications", McGraw-Hill, Inc., 1984.
3. Ellis Horowitz, SartajSahni, Susan Anderson-Freed, "Fundamentals of Data Structures in C", Second Edition, 2008, Universities Press Pvt. Ltd. Hyderabad.
4. Seymour, Lipchitz. "Data Structures with C."TMH (2010).

MCPC1008 COMPUTER ORGANIZATION AND ARCHITECTURE (3-0-0)

Objectives:

- To obtain the basic architectural and organizational concepts of a digital computer.
- To analyze performance issues in processor and memory design of a digital computer.
- To understand processor performance improvement using instruction level parallelism.

Course Outcomes(CO):

After successful completion of the course the student will be able to:

CO1: Understand background of internal communication of computer and have better idea on how to write assembly language programs.
CO2: Be clear with memory management techniques.
CO3: Understand the communication IO devices with processor.
CO4: Notice how to perform computer arithmetic operations.
CO5: Be clear with pipeline procedure and multi processors.

Module-I

Introduction: Review of basic computer architecture, Quantitative techniques in computer design, measuring and reporting performance.

Module-II

Pipelining : Basic concepts, Instruction and Arithmetic pipeline, Data hazards, Control hazards and Structural hazards, Techniques for handling hazards. Exception handling. Pipeline optimization techniques.

Module-III

Hierarchical memory technology: Inclusion, Coherence and locality properties, Cache memory organizations, Techniques for reducing cache misses; Virtual memory organization, Mapping and Management techniques, Memory replacement policies. Instruction-level Parallelism: Basic concepts, Techniques for increasing ILP, Superscalar, Superpipelined and VLIW Processor architectures. Array and Vector processors.

Module-IV

Multiprocessor architecture: Taxonomy of Parallel Architectures, Centralized shared-memory architecture, Synchronization, Memory consistency, Interconnection networks. Distributed shared memory architecture. Cluster computers.

Books:

1. Morris Mano," Computer System Architecture", PHI
2. William Stallings, "Computer Organization and Architecture – Designing for Performance", Sixth Edition, Pearson Education, 2003
3. Carl Hamacher, Zvonko Vranesic and Safwat Zaky, "Computer Organization", Fifth Edition, Tata McGraw Hill, 2002.
4. Patterson, "Computer Organisation and Design", Elsevier
5. John P Hayes, "Computer Organization", McGraw Hill

MCPC1009 THEORY OF COMPUTATION (3-0-0)

Objectives:

1. Apply theory of computation concepts to solve problems in computer science
2. Understand the fundamental concepts of automata theory, formal languages, and computation models
3. Analyze and design finite automata
4. Understand the basics of Theory of Computation, design and minimize finite automata
5. Study the properties of regular languages, context-free languages
6. Analyze and design pushdown automata, understand context-free grammars
7. Understand Turing machines, analyze undecidable problems and recursively enumerable languages
8. Analyze complexity, understand formal language properties

Course Outcomes(CO):

Upon successful completion of this course, the student shall be able to:

CO1: Apply finite automata concepts to solve problems and describe the types of grammar and derivation tree

CO2: Analyze a given Finite Automata machine and find out its Language and apply pushdown automata and context-free grammar concepts to solve problems

CO3: Apply Turing machine concepts to solve problems

CO4: Apply complexity theory and formal language property concepts to solve problems

CO5: Develop a computational model using Turing machine for the given problem. · Examine the complexity for P and NP completeness for the given problem.

Module-I

Introduction to Theory of Computation, Finite Automata (FA): Deterministic FA (DFA) and Nondeterministic FA (NFA), Finite Automata with Epsilon-Transition.

Module-II

Regular expressions, Finite automata and Regular expressions, Applications of regular expressions, Algebraic laws of regular expressions, Pumping Lemma and its application for regular languages, Closure and Decision properties of regular languages.

Module-III

Context-Free Grammars, Parse trees, Ambiguity in Grammar & Languages, Pushdown automation. The language of PDA. Equivalence of PDA's and CFG's. Deterministic pushdown automata, Chomsky Normal form, the pumping Lemma for context free languages, Decision properties of CFL's.

Module-IV

The Turing machine, Programming techniques for Turing machines, Extension to the basic Turing machine, Restricted Turing machine, Turing machines and computers.

Non-Recursively enumerable languages, Undecidable problem that in recursively enumerable, Undecidable problem about Turing machines, Post's correspondence problem, other undecidable problems.

Books:

1. Introduction to Automata Theory, Languages and Computation- J.Hoperoft, R.Motwani ,J.D.Ullman– Pearson Education

Reference Books:

1. Introduction to Theory of Computation– M.Siper, Thomson Learning
2. P.Linz," An Introduction to formal Languages and Automata",Norasa,2000
3. Lewish Papadimitra: Theory of Computations, Prentice Hall of India, New Delhi.

MCHS1002 UNIVERSAL HUMAN VALUES & PROFESSIONAL ETHICS (2-0-0)

Objectives:

This course is intended to:

1. To assist students in recognizing the fundamental interdependence between 'VALUES' and 'SKILLS' in achieving enduring happiness and prosperity, which are the primary objectives of all individuals.
2. To promote the cultivation of a holistic perspective among students regarding life, profession, happiness, and prosperity, grounded in an accurate comprehension of human reality and the broader existence. This comprehensive viewpoint underpins Universal Human Values and the transition towards a naturally value-oriented existence.
3. To emphasize the potential consequences of a holistic understanding regarding ethical human behavior, trustworthy and mutually satisfying interactions among individuals, and meaningful relationships with Nature.
4. This course aims to offer essential guidance in value education to inquisitive youth.

Course Outcomes (CO)

CO1 At the end of the course, students are expected to become more aware of themselves, and their surroundings (family, society, nature);

CO2 They would develop greater responsibility in life and in addressing issues with sustainable solutions, while considering human relationships and human nature.

CO3 They would possess enhanced critical faculties.

CO4 They would also develop sensitivity to their dedication to their understanding of human values, relationships, and society.

CO5 It is anticipated that they will apply their acquired knowledge to various real-life situations, marking a preliminary step in this direction.

Module-I

Introduction to Value Education

Right Understanding, Relationship and Physical Facility (Holistic Development and the Role of Education) Understanding Value Education, Self-exploration as the Process for Value Education, Continuous Happiness and Prosperity – the Basic Human Aspirations, Happiness and Prosperity – Current Scenario, Method to Fulfil the Basic Human Aspirations

Module-II

Harmony in the Human Being :

Understanding Human being as the Co-existence of the Self and the Body, Distinguishing between the Needs of the Self and the Body, The Body as an Instrument of the Self,

Understanding Harmony in the Self, Harmony of the Self with the Body, Programme to ensure self-regulation and Health

Module-III

Harmony in the Family and Society: Harmony in the Family – the Basic Unit of Human Interaction, 'Trust' – the Foundational Value in Relationship, 'Respect' – as the Right Evaluation, Other Feelings, Justice in Human-to- Human Relationship, Understanding Harmony in the Society, Vision for the Universal Human Order

Module-IV

Harmony in the Nature/Existence :

Understanding Harmony in the Nature, Interconnectedness, self-regulation and Mutual Fulfilment among the Four Orders of Nature, Realizing Existence as Co-existence at All Levels, The Holistic Perception of Harmony in Existence.

Module-V

Implications of the Holistic Understanding – a Look at Professional Ethics : Natural Acceptance of Human Values, Definitiveness of (Ethical) Human Conduct, A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order, Competence in Professional Ethics Holistic Technologies, Production Systems and Management Models-Typical Case Studies, Strategies for Transition towards Value-based Life and Profession

Books:

- The Textbook A Foundation Course in Human Values and Professional Ethics, R R Gaur, R Asthana, G P Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978- 93-87034- 47-1
- The Teacher's Manual for A Foundation Course in Human Values and Professional Ethics, R R Gaur, R Asthana, G

Reference Books

- Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amar kantak, 1999.
- Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.

MCPC1204 OBJECT ORIENTED PROGRAMMING LAB (0-0-3)

List of Programs:

1. Write a program in Java to find the set of prime numbers from 1 to 100.
2. Write a program to compare two objects. Create two objects representing two complex number and find the larger one.
3. Write a Java Program to convert a Number to Word.
4. Write a Java Program to copy all elements of one array into another array
5. Write a Java Program to sort the elements of an array in ascending order
6. Write a Java Program to find the frequency of odd & even numbers in the given matrix
7. Write a Java Program to determine whether a given string is palindrome
8. Write a Java program to draw a pattern such as

	000*000*
2 4	0*00*00*0
3 6 9	00*0*0*00
4 8 12 16	000***000

9. Write a Java program to convert Decimal to Binary in Java

10. Write a program to add two times given in hour minutes and seconds using class and object.
11. Write a Java program to find the combination c(n,r) by inheriting from a class that computes the factorial of a number.
12. Write a Java program to find the area of different geometrical shapes using polymorphism.
13. Write a Java program to create a user defined package that finds the largest among an array of n numbers. Use this package to sort an array of n numbers using insertion/selection sort.
14. Create three threads and print 1 to 10 in each thread.
15. Write a Java program to illustrate the concept of some exceptions such as divide by zero or array index out of bound etc.

MCPC1205 SOFTWARE ENGINEERING LAB (0-0-3)

List of Experiments:

1. Identifying the Requirements from Problem Statements.
   Requirements, Characteristics of Requirements, Categorization of Requirements, Functional Requirements, Identifying Functional Requirements
2. Estimation of Project Metrics
   Project Estimation Techniques, COCOMO, Basic COCOMO Model, Intermediate COCOMO Model, Complete COCOMO Model, Advantages of COCOMO, Drawbacks of COCOMO, Halstead's Complexity Metrics
3. Modeling UML Use Case Diagrams and Capturing Use Case Scenarios
   Use case diagrams, Actor, Use Case, Subject, Graphical Representation, Association between Actors and Use Cases, Use Case Relationships, Include Relationship, Extend Relationship, Generalization Relationship, Identifying Actors, Identifying Use cases, Guidelines for drawing Use Case diagrams
4. E-R Modeling from the Problem Statements
   Entity Relationship Model, Entity Set and Relationship Set, Attributes of Entity, Keys, Weak Entity, Entity Generalization and Specialization, Mapping Cardinalities, ER Diagram, Graphical Notations for ER Diagram, Importance of ER modeling
5. Identifying Domain Classes from the Problem Statements
   Domain Class, Traditional Techniques for Identification of Classes, Grammatical Approach Using Nouns, Advantages, Disadvantages, Using Generalization, Using Subclasses, Steps to Identify Domain Classes from Problem Statement, Advanced Concepts
6. Statechart and Activity Modeling
   Statechart Diagrams, Building Blocks of a Statechart Diagram, State, Transition, Action, Guidelines for drawing Statechart Diagrams, Activity Diagrams, Components of an Activity Diagram, Activity, Flow, Decision, Merge, Fork, Join, Note, Partition, Guidelines for drawing an Activity Diagram
7. Modeling UML Class Diagrams and Sequence diagrams
   Structural and Behavioral aspects, Class diagram, Elements in class diagram, Class, Relationships, Sequence diagram, Elements in sequence diagram, Object, Life-line bar, Messages
8. Modeling Data Flow Diagrams
   Data Flow Diagram, Graphical notations for Data Flow Diagram, Explanation of Symbols used in DFD, Context diagram and leveling DFD
9. Estimation of Test Coverage Metrics and Structural Complexity

Control Flow Graph, Terminologies, McCabe's Cyclomatic Complexity, Computing Cyclomatic Complexity, Optimum Value of Cyclomatic Complexity, Merits, Demerits

10. Designing Test Suites
Software Testing, Standards for Software Test Documentation, Testing Frameworks, Need for Software Testing, Test Cases and Test Suite, Types of Software Testing, Unit Testing, Integration Testing and System Testing.

MCPC1206 DATA STRUCTURE LAB (0-0-3)

List of experiments:

1 Implementation of Stack Using Array.
2 Implementation of Queue Using Array.
3 Implementation of Infix to Postfix Conversion using Stack.
4 Evaluation of Postfix Expression using Stack.
5 Implementation of the following operations on Single linked list:
i) Creation ii) Insertion iii) Deletion iv) Traversal in both ways
6 Implementation of the following operations on Double linked list:
i) Creation ii) Insertion iii) Deletion
7 Implementation of Stack Using Linked List.
8 Implementation of Queue Using Linked List.
9 Implementation of the following operations on Binary Tree:
i) Creation ii) Insertion iii) Deletion.
10 Implementation of Binary Tree Traversal : Preorder, Inorder and Postorder.
11 Implementation of Binary Search Tree.
12 Implementation of sorting algorithms : Bubble Sort, Selection Sort, Insertion Sort, Quick Sort, Merge Sort and Heap sort.
13 Implementation of Searching Algorithms : Linear Search and Binary Search
14 Implementation of Breadth First Search (BFS) in a Graph.
15 Implementation of Depth First Search (DFS) in a Graph.
16 Implementation of Hashing using hash functions

MCPC1207 PROGRAMMING IN PYTHON LAB (0-0-3)

List of Programs:

1. Write a Program to read and print values of variables of different data types.
2. Write a program to perform addition, subtraction, multiplication, division and modulo division on two integers.
3. Write a program to input two numbers and check whether they are equal or not.
4. Write a program that prompts user to enter a character (O, A, B, C, F). Then using if-elseif-else construct display Outstanding, Very Good, Good, Average and Fail respectively.
5. Write a program to print Fibonacci series using recursion.
6. Write a program that prints absolute value, square root and cube root of a number. (import math package).
7. Write a program that finds the greatest of three given numbers using functions. Pass three arguments.
8. Write a program to get a string made of the first 2 and last 2 characters from a given string. If the string length is less than 2, return empty string.
9. Write a program that fetches data from a specified url and writes it in a file.

BACHELOR OF TECHNOLOGY
FOR ADMISSION BATCH 2023-24
MECHANICAL ENGINEERING
SECOND YEAR (THIRD SEMESTER)

Sl. No.	Category	Course Code	Course	Contact Hrs. L-T-P	Credit	University Marks	Internal Evaluation
Subject (Theory)							
1	BS	HSBS2001	Mathematics - III	3-0-0	3	100	50
2	PC	MEPC2001	Mechanics of Solids	3-0-0	3	100	50
3	PC	MEPC2002	Engineering Thermodynamics	3-0-0	3	100	50
4	PC	MFPC2002	Introduction to Physical Metallurgy and Engineering Materials	3-0-0	3	100	50
5	PC(ACC)	PCAC2001	Python Programming	3-0-0	2	100	50
		PCAC2002	Data Science Foundations				
		PCAC2003	Web and Application Development				
		PCAC2004	Cloud Computing Foundation				
		PCAC2005	Programming Internet of Things				
		PCAC2006	Robotics : Motion Planning				
		PCAC2007	IT Fundamentals for Cybersecurity - I				
6	HS	HSHS2001	Engineering Economics	3-0-0	2	100	50
		HSHS2002	Organizational Behaviour				
Subject (Sessional / Practical)							
7	PC	MEPC2201	Machine Drawing and Solid Modelling	0-0-3	1.5	-	100
8	PC	MEPC2202	Material Testing Lab.	0-0-3	1.5	-	100
9	PC	MEPC2203	Thermal Engineering Lab.	0-0-3	1.5	-	100
10	PC(ACC)	PCAC2201	Python Programming Lab.	0-0-3	1.5	-	100
		PCAC2202	Data Science Foundations Lab.				
		PCAC2203	Web and Application Development Lab.				
		PCAC2204	Cloud Computing Foundation Lab.				
		PCAC2205	Programming Internet of Things Lab.				
		PCAC2206	Robotics : Motion Planning Lab.				
		PCAC2207	IT Fundamentals for Cybersecurity - I Lab.				
			Total	**18-0-12**	**22**	**600**	700

Note: Click here to view/download the syllabus of the subjects.

HSBS2001 MATHEMATICS-III (3-0-0)

Module 1: Laplace Transforms (8 Hours)
Laplace transforms, inverse transforms, linearity, shifting, transforms of derivatives and integrals, solution of ODEs, unit step function, Dirac's delta function, differentiation and integration of transforms, convolution, integral equations.

Module 2: Fourier series & Applied PDE's (8 Hours)
Fourier series: Euler's formula, 2π and arbitrary periodic functions, even and odd functions.
Elementary PDE's: Method of separation of variables (simple problems). One dimensional wave equation: solution by separation of variables, One dimensional heat equation: solution by Fourier series.

Module 3: Basic Probability (8 Hours)
Axiomatic definition of probability, Basic properties, conditioning and independence, Random variables (discrete and continuous), probability mass and density functions, cumulative distribution functions, moments of random variables, mean and variance.

Module 4: Probability Distributions (8 Hours)
Discrete Probability distributions: Binomial, Poisson and hyper-geometric distributions. Continuous Probability distributions: exponential, uniform and normal distributions.

Module 5: Applied Statistics (8 Hours)
Random sampling, estimation of parameters, maximum likelihood estimation, confidence intervals. Regression and correlation analysis: fitting of straight lines (method of lest squares), correlation coefficientwith basic properties.

Text Books:

1. Advanced Engineering Mathematics by E. Kreyszig, John Willey & Sons Inc. 10th Edition.
2. Ronald E. Walpole, Raymond H. Myers, Sharon L. Myers & Keying Ye, "Probability & Statistics for Engineers & Scientists", Eighth Edition, 2007, Pearson Education Inc., NewDelhi.

Reference Books:

1. Ordinary and Partial Differential equations by J. Sinha Roy and S. Padhy, Kalyani Publishers.
2. Higher Engineering Mathematics by B. V. Ramana, McGraw Hill Education.
3. Engineering Mathematics by Pal and S. Bhunia, Oxford Publication.
   Stochastic Processes, 2nd Edition by Roy D. Yates, Rutgers and David J. Goodman, JohnWiley and Sons, INC.

HSHS2001 ENGINEERING ECONOMICS (3-0-0)

Objectives:
To provide basic concept of micro and macro economics, engineering economics and their application in engineering economy. Further, to develop the ability to account for time value of money using engineering economy factors and formulas.

Module - I (05 hours)
Engineering Economics- Nature, Scope, Basic problems of an economy, Micro Economics and Macro Economics.
Demand - Meaning of demand, Demand function, Law of Demand and its exceptions, Determinants of demand, Elasticity of demand & its measurement (Simple numerical problems to be solved), Demand Forecasting Meaning
Supply-Meaning of supply, Law of supply and its exception, Determinants of supply, Elasticity of supply, Determination of market equilibrium (Simple numerical problems to be solved).

Module - II (O8 hours)
Production - Production function, Laws of returns: Law of variable proportion, Law of returns to scale
Cost and Revenue Concepts - Total Costs, Fixed cost, Variable cost, Total revenue, Average revenue and Marginal revenue, Cost-Output Relationships in the Short Run, and Cost-Output Relationships in theLong Run, Analysis of cost minimization.

Module III (08 hours)
Market - Basic understanding of different market structures, Determination of equilibrium price under perfect competition (Simple numerical problems to be solved), Break Even Analysis-linear approach (Simple numerical problems to be solved).

Module - IV (12 hours)
Time Value of Money- Interest - Simple and compound, nominal and effective rate of interest, Cash flow diagrams, Principles of economic equivalence.
Evaluation of Engineering Projects -Present worth method, Future worth method, Annual worth method, Internal rate of return method, Cost benefit analysis for publicprojects.
Depreciation- Depreciation of capital assert, Causes of depreciation, Methods of calculating depreciation - Straight line method, Declining balance method, SOYD method, After tax comparison of project

Module V (06 Hours)

Inflation-Meaning of inflation, types, causes, measures to control inflation.
National Income-Definition, Concepts of national income, Method of measuring national income.
Banking -Commercial bank. Functions of commercial bank, Central bank, Functions of Central Bank.

Books:

1. Principles of Economics by Deviga Vengedasalam and Karaunagaran Madhavan, Oxford
2. Riggs, Bedworth and Randhwa, "Engineering Economics", McGraw Hill Education India
3. C. S. Park, Contemporary Engineering Economics, 6th Edition, Pearson Education, 2015.
4. Engineering Economy by William G.Sullivan, Elin M.Wicks, C. Patric Koelling, Pearson
5. R.Paneer Seelvan, " Engineering Economics", PHI
6. Ahuja,H.L., "Principles of Micro Economics" , S.Chand & Company Ltd
7. Jhingan,M.L., "Macro Economic Theory"

8. Macro Economics by S.P.Gupta, TMH

Course Outcomes of Engineering Economics

At the end of the course the students will be able to

CO1 Remembering : Define the basic concept of micro and macro economics, engineering economics and their application in engineering economy.

CO2 Understanding : Evaluate numerically the effects of changes in demand and supply on price determination of products and services.

CO3 Analyze : the macroeconomic environment and financial systems of the country and its impact on business, society and enterprise.

CO4 Develop : the ability to account for time value of money using engineering economy factors and formulas.

CO5 Apply: knowledge of mathematics, economics and engineering principles to solve engineering problems and to analyze decision alternatives in engineering projects considering upon depreciation, taxes and inflation.

HSHS2002 ORGANISATIONAL BEHAVIOUR (3-0-0)

Objectives:
The objective is to develop an understanding of the behavior of individuals and groups inside organizations and to enhance skills in understanding and appreciating individuals, interpersonal, and group process for increased effectiveness both within and outside of organizations. Further, it is to develop theoretical and practical insights and problem-solving capabilities for effectively managing the organizational processes.

Module-I: (06 Hrs.)
Fundamentals of OB: Definition, scope and importance of OB, Relationship between OB and the individual, Evolution of OB, Theoretical framework (cognitive), behavioristic and social cognitive), Limitations of OB.

Module-II: (12 Hrs.)
Attitude: Importance of attitude in an organization, Right Attitude, Components of attitude, Relationship between behavior and attitude, Developing Emotional intelligence at the workplace, Job attitude, Barriers to changing attitudes.
Personality and values: Definition and importance of Personality for performance, The Myers-Briggs Type Indicator and The Big Five personality model, Significant personality traits suitable to the workplace (personality and job — fit theory), Personality Tests and their practical applications.
Perception: Meaning and concept of perception, Factors influencing perception, Selective perception, Attribution theory, Perceptual process, Social perception (stereotyping and halo effect). Motivation: Definition & Concept of Motive & Motivation, The Content Theories of Motivation (Maslow's Need Hierarchy & Herzberg's Two Factor model Theory), The Process Theories (Vroom's expectancy Theory & Porter Lawler model), Contemporary Theories — Equity Theory of Work Motivation.

Module-III: (10 Hrs.)
Foundations of Group Behavior: The Meaning of Group & Group behavior & Group Dynamics, Types of Groups, The Five — Stage Model of Group Development.
Managing Teams: Why Work Teams, Work Teams in Organization, Developing Work Teams, Team Effectiveness & Team Building.
Leadership: Concept of Leadership, Styles of Leadership, Trait Approach Contingency Leadership Approach, Contemporary leadership, Meaning and significance of contemporary leadership, Concept of transformations leadership, Contemporary theories of leadership, Success stories of today's Global and Indian leaders.

Module-IV: (08 Hrs.)
Organizational Culture : Meaning & Definition of Organizational Culture, creating & Sustaining Organizational Culture, Types of Culture (Strong vs. Weak Culture, Soft Vs. Hard Culture & Formal vs. Informal Culture), Creating Positive Organizational Culture, Concept of Workplace Spirituality.

Module-V: (09 Hrs.)
Organizational Change: Meaning, Definition & Nature of Organizational Change, Types of Organizational Change, Forces that acts as stimulants to change.
Implementing Organizational Change : How to overcome theResistance to Change, Approaches to managing Organizational Change, Kurt Lewin's-Three step model, Seven Stage model of Change & Kotter's Eight-Step plan for Implementing Change, Leading the Change Process, Facilitating Change, Dealing with Individual & Group Resistance, Intervention Strategies for Facilitating Organizational Change, Methods of Implementing Organizational Change, Developing a Learning Organization.

Course Outcomes:

At the end of the course, students will be able to:

1. Understand the basic concepts of OB, change management, organizational culture and their implementation in organizations.
2. Identify and examine team characteristics for improved organizational performance.
3. Apply theories and frameworks to solve problems and take effective decisions for organizational success.
4. Analyze group behavior and leadership styles for effective people management.
5. Evaluate individual personality types and group behaviours for improving organizational processes and practices.
6. Develop leadership competency to manage organizational situations.

Books:

1. Understanding Organizational Behaviour, Parek, Oxford
2. Organizational Behaviour, Robbins, Judge, Sanghi, Pearson.
3. Organizational Behaviour, K. Awathappa,HPH.
4. Organizational Behaviour, VSP Rao, Excel
5. Introduction to Organizational Behaviour, Moorhead, Griffin, Cengage.
6. Organizational Behaviour, Hitt, Miller, Colella, Wiley.

MEPC2001 MECHANICS OF SOLID (3-0-0)

Module–I(08Hours)

Stress and Strain: Definition of stress, stress tensor - normal and shearing stresses in axially loaded members. Normal and shearing strains - stress-strain relationship - Generalized Hooke's Law - Poisson's ratio - relationship between material properties of isotropic materials - stress-strain diagram for uniaxial loading for ductile and brittle materials,strain gauges and rosettes, testing of materials with universal testing machine.Composite bars in tension and compression, temperature stresses.

Module–II(06Hours)

Two Dimensional State of Stress and Strain:Principalstresses,principalstrainsandprincipalaxes,calculationofprincipalstressesfromprincipalstrains, Mohr's Circle, Stressesinthincylinderandthinspherical shellsunderinternalpressure.

Module –III(08 Hours)

Shear Force and Bending Moment Diagram: For simple beams, support reactions for staticallydeterminant beams, relationship between bending moment and shear force, shear force and bendingmomentdiagrams.

Pure bending: Theory of initially straight beams, distribution of normal and shear stress, beams of twomaterials.Deflectionof beamsbyintegrationmethodandareamomentmethod.

Module – IV(04Hours)

Torsionofsolidcircularshafts,twistingmoment,strengthofsolidandhollowcircularshaftsand strength ofshaftsincombinedbendingandtwisting, Closed coiled helical springs.

Module – V(04Hours)

Bucklingofcolumns: Euler'stheoryofinitiallystraightcolumnswithvariousendconditions,Slenderness Ratio, Eccentricloadingofcolumns.Columnswithinitialcurvature.

Course Outcomes

Upon completion of the course, students will be able to:

CO1 Gain a fundamental understanding of the concepts of stress and strain by analysis ofsolids and structures.

CO2 Study engineering properties of materials, force-deformation, stress-strainrelationship & learn fundamental principles of equilibrium, compatibility, and force deformation relationship in linear solids and structures.

CO3 Analyze determinate and indeterminate axial members, torsional members, andbeams, and determine axial forces, torque, shear forces, and bending moments.

CO4 Learn the fundamental concepts of flexibility method,and stiffness method as applied to problems involving statically determinate andindeterminate axial and torsional members, and beams.

CO5 Analyze and design thin, thick cylinders and springs and buckling in columns.

TextBooks:

1. Strengthofmaterials,G. H. Ryder,McMillanIndiaLtd.
2. ElementsofStrengthofMaterials,S. P.Timoshenko, D.H.Young, East WestPress Pvt.Ltd.

ReferenceBooks:

1. Introductionto solidmechanics,H.Shames, Prentice HallIndia, NewDelhi
2. Engineeringmechanics of solid, E.P. Popov,Prentice Hall India, New Delhi
3. Mechanics of materials by Beer and Johnston, Tata McGraw Hill.

MEPC2002 ENGINEERING THERMODYNAMICS (3-0-0)

Course Objective:"The course aims to provide students with a comprehensive understanding of the principles of thermodynamics and their applications in engineering so that students will be able to analyze and solve problems related to energy conversion, heat transfer, and the properties of pure substances, preparing them for advanced studies and professional practice in mechanical engineering."

Module-I(06hrs)

Review of First and Second laws, First law analysis of steady andtransient flow control volumes, Entropy generation,Entropy balance for closed systems and steady flow systems.

Module-II(06hrs)

Available energy, Quality of energy,Availability for non-flow and flow process, Irreversibility, Exergy balance, Second law efficiency.

Module-III(06hrs)

Vapour Power Cycles: The carnot vapor cycle and its limitations, The Rankine cycle, Means of increasing the Rankine cycle efficiency, The reheat cycle, The regenerative feed heating cycle, Cogeneration (Back pressure and Pass-out turbines).

Module-IV(06hrs)

General Thermodynamic property relations: The Maxwell relations, The Clapeyron equation, The TdS relations, Isothermal compressibility and volume expansivity, The Joule-Thomson coefficient.

Gas Power Cycles: Air standard cycles- Otto, Diesel, Dual Combustion cycles, Simple Brayton cycle.

Module-V(06hrs)

Reciprocating Air Compressors: Introduction (Uses of compressed air), The reciprocating cycle neglecting and considering clearance volume, Volumetric efficiency and its effect on compressor performance, Limitations of single stage compression, Multistage compression and intercooling, Optimum intercooler pressure, Simple calculations on reciprocating compressors.

Course Outcomes:

Upon completion of the course, students will be able to:

CO1 Define the concepts of continuum, Thermodynamic systems, Thermodynamic properties, Thermodynamic equilibrium and evaluate properties of pure substance, Work and Heat.

CO2 Apply the First law of thermodynamics to analyze closed system and control volume.

CO3 Apply the Second Law of Thermodynamics to evaluate the performance of thermal power plant, refrigerator and heat pump and evaluate principle of increase of entropy.

CO4 Evaluate Availability, Irreversibility and the Second Law efficiency.

CO5 Analyze Air standard cycles.

Books:

- EngineeringThermodynamicsbyP.K.Nag,Publisher: TMH
- EngineeringThermodynamicsbyP.Chattopadhyay, OXFORD
- FundamentalsofThermodynamicsbySonntag,Borgnakke,VanWylen,JohnWiley&Sons
- ThermodynamicsAnEngineeringApproach byYunusA.CingelandMichaleA.Boles,TMH
- EngineeringThermodynamicsbyM.Achyuthan,PHI

MEPC2201 MACHINE DRAWING AND SOLID MODELLING LAB (0-0-3)

Course Objective:"This laboratory course aims to develop students' skills in creating detailed machine drawings and 3D solid models using computer-aided design (CAD) software so that students will be proficient in interpreting technical drawings, designing mechanical components, and producing accurate models, essential for effective communication and design in engineering practice."

List of Experiments

1. Sketcher workbench:
    a. Creating sketches
    b. Selecting & Editing of Geometry, Features, Models
    c. Creating Sketcher Geometry & Using Sketcher Tools
    d. Using Sketches & Datum Features
2. Basic Solid part modelling
    a. Creating Extrudes, Revolves, and Ribs
    b. Creating Holes, Shells, Draft & Patterns
    c. Creating Rounds, Chamfers & Using Layers
3. Advance Solid Part Modeling
    a. Advanced Selection, Creating Sweeps and Blends
    b. Sweeps with Variable Sections
    c. Helical Sweeps & Swept Blends
    d. Relations, Parameters & Family Tables
    e. Measuring and Inspecting Models.
4. Assembly design:
    a. Creating assembly with top-down approach and bottom- up approach
    b. Assembling with Constraints, Exploding, Replacing Components,
    c. Cross- Sections in Assemblies
5. Drafting workbench:
    a. Introduction, creating new drawings and drawing views,
    b. Adding model details and tolerance information to drawings.
    c. Adding notes, symbols, tables, balloons and layers in drawings.

MEPC2202 MATERIAL TESTING LAB (0-0-3)

Course Objective: "This laboratory course aims to familiarize students with the techniques and equipment used to evaluate the properties and performance of engineering materials so that students will be able to conduct standard material tests, analyze data, and understand the mechanical behavior of materials under various conditions, reinforcing theoretical knowledge from material science courses."

List of Experiments:

1. Determination of tensile strength of materials by Universal Testing Machine.
2. Determination of compressive strength of materials by Universal Testing Machine.
3. Determination of bending strength of materials by Universal Testing Machine.
4. Double shear test in Universal Testing Machine.
5. Determination of rigidity modulus of material.
6. Determination of fatigue strength of material.
7. Estimation of spring constant under tension and compression.
8. Load measurement using load indicator, Load Cells.
9. Strain measurement using strain gauge.
10. Stress measurement using strain rosette.

MEPC2203 THERMAL ENGINEERING LAB (0-0-3)

Course Objective: "This laboratory course aims to provide students with practical experience in analyzing and evaluating thermal systems and processes so that students will be able to conduct experiments, interpret data, and apply principles of thermodynamics and heat transfer to real-world engineering problems, enhancing their understanding of thermal engineering concepts."

List of Experiments:

1. Study of Cut-Sections of 2 stroke and 4 stroke Diesel Engine/Petrol engine.
2. Study of steam power plant.
3. Study of refrigeration system.
4. Study of gas turbine power plant.
5. Performance analysis of reciprocating air-compressor.
6. Performance analysis of Centrifugal / Axial Flow compressor.
7. Determination of performance characteristics of gear pump.
8. Load test on 4-stroke single cylinder C.I. engine.
9. Load test on 4-stroke single cylinder S.I. engine.
10. Morse Test on multi-cylinder S.I. or C.I. engine

MEPC2002 INTRODUCTION TO PHYSICAL METALLURGY AND ENGINEERING MATERIALS (3-0-0)

Course Objectives:"This course aims to equip students with fundamental knowledge of physical metallurgy and engineering materials so that students will understand the structure, properties, processing, and performance of various engineering materials, enabling them to select and apply appropriate materials in mechanical design and manufacturing processes."

MODULE-I(08hrs)

Philosophy behind study of material science, Classification and properties of engineering materials. Crystal structures, Mechanism of crystallization, Defects in crystal structure, Plastic deformation by slip and twinning, Effects of cold working on properties, Review of strengthening methods, Hot working

MODULE-II(06hrs)

Constitutions of Alloys: Pure metal, Intermediate alloy phase, solid solution: Substitutional and interstitial. Hume- Rothery Rules Phase Diagram: Binary phase diagram, phase diagram rules, iron-carbon equilibrium diagram, phase transformation in iron-carbon system, Lever rules

MODULE-III(05hrs)

Heat Treatment of Steels: Structure and properties of common engineering materials, Annealing: different types of annealing, Normalizing, Hardening

MODULE-IV(06hrs)

Time Temperature Transformation (TTT) diagram, different cooling curves and transformation on continuous cooling, Tempering, sub-zero treatment of steel, Defects due to heat treatment. Surface Hardening of Steels: Induction hardening, Flame hardening, Case hardening: Carburizing, Nitriding, Cyaniding, carbonitriding, Diffusion coating.

MODULE-V(05hrs)

Introductory Ideas on Ferrous Alloys, Effect of alloying elements on the properties of steels, general classification of steels, Steel designation, Cast Iron. Nonferrous Alloys: Plastics, Ceramics, Composite materials, Common applications of various materials

Course Outcomes:

Upon completion of the course, students will be able to:

CO1	Understand the crystal structure and classification of engineering materials.
CO2	Understand the classification of ferrous and nonferrous alloy and study their applications.
CO3	Interpret the phase diagrams of materials.

CO4	Understand heat treatment and surface hardening processes affecting mechanical properties of metals and alloys.
CO5	Understand the effect of alloying and composite materials.

Books:

- IntroductiontoPhysicalMetallurgybyAvner,TataMcGrawHill
- MaterialsScienceandEngineeringbyW.D.Callister,WileyandSonsInc.
- PhysicalMetallurgy:PrinciplesandPracticebyRagahvan,PHI

PCAR 2001 PYTHON PROGRAMMING (3-0-0)

OVERALL COURSE OBJECTIVES: The objective of this course is to provide learners with a comprehensive understanding of Python, from basic programming to handling complex data structures and accessing web data. By the end, learners should be proficient in Python and be able to use their skills to extract, parse, and analyze data. Moreover, they should be equipped to take on further advanced programming courses.

Module 1: Programming for Everybody (Getting Started with Python) [19 Hours]

This course aims to teach everyone the basics of programming computers using Python. We cover the basics of how one constructs a program from a series of simple instructions in Python. The course has no prerequisites and avoids all but the simplest mathematics. Anyone with moderate computer experience should be able to master the materials in this course. This course will cover Chapters 1-5 of the textbook "Python for Everybody". Once a student completes this course, they will be ready to take more advanced programming courses. This course covers Python 3.

Sub-Topics
Installing Python
Python as a Language
Eben Upton and the RaspBerry Pi
Variables and Expressions
Conditional Code
Conditional Statements
Loops and Iteration

Formative Assessments:
5 quizzes, 1 peer-review assignment, and 7 coding/lab assignments.

Module 2: Python Data Structures [19 Hours]

This course will introduce the core data structures of the Python programming language. We will move past the basics of procedural programming and explore how we can use the Python built-in data structures such as lists, dictionaries, and tuples to perform increasingly complex data analysis. This course will cover Chapters 6-10 of the textbook "Python for Everybody". This course covers Python 3.

Sub-Topics
Strings
Files
Lists
Dictionaries
Tuples

Formative Assessments:
5 quizzes, 1 peer-review assignment, and 7 coding/lab assignments.

Module 3: Using Python to Access Web Data [19 Hours]

This course will show how one can treat the Internet as a source of data. We will scrape, parse, and read web data as well as access data using web APIs. We will work with HTML, XML, and JSON data formats in Python. This course will cover Chapters 11-13 of the textbook “Python for Everybody”. To succeed in this course, you should be familiar with the material covered in Chapters 1-10 of the textbook and the first two courses in this specialization. These topics include variables and expressions, conditional execution (loops, branching, and try/except), functions, Python data structures (strings, lists, dictionaries, and tuples), and manipulating files. This course covers Python 3.

Sub-Topics
Regular Expressions
Networks and Sockets
Programs that Surf the Web
Web Services and XML
JSON and the REST Architecture

Formative Assessments:
5 quizzes and 8 coding/lab assignments

LEARNING OUTCOMES: On successful completion of the course the students shall be able to:

1. Demonstrate understanding of basic programming concepts in Python, including constructing simple programs.
2. Apply gained Python proficiency to pursue more advanced programming courses.
3. Evaluate and use Python's core data structures such as lists, dictionaries, and tuples for sophisticated data analysis.
4. Extract and interpret data from the internet using Python’s web scraping tools and APIs.
5. Interpret and manipulate web data, specifically HTML, XML, and JSON, using Python.
6. Synthesize various Python concepts, such as handling different data structures and manipulation of web data, to solve complex problems.

PCAC2002 DATA SCIENCE FOUNDATIONS (3-0-0)

OVERALL COURSE OBJECTIVES: To enhance students' aptitude in implementing scalable data science platforms, and understanding big data landscape with a focus on using statistical measures, data visualization, advanced tools, and specific processes that aid in detecting data trends, minimizing inconsistencies, and improving overall data analysis.

Module 1: Introduction to Data Science in Python [35 Hours]

This course will introduce the learner to the basics of the Python programming environment, including fundamental Python programming techniques such as lambdas, reading and manipulating csv files, and the numpy library. The course will introduce data manipulation and cleaning techniques using the popular Python pandas data science library and introduce the abstraction of the Series and DataFrame as the central data structures for data analysis, along with tutorials on how to use functions such as group by, merge, and pivot tables effectively. By the end of this course, students will be able to take tabular data, clean it, manipulate it, and run basic inferential statistical analyses.

Sub-Topic
Fundamentals of Data Manipulation with Python
Data Processing with Pandas
Answering Questions with Messy Data

Formative Assessments:
4 quizzes and 9 coding/lab assignments.

Module 2: Introduction to Big Data [17 Hours]

This course provides an introduction to the Big Data landscape for beginners interested in data science. It includes an overview of key concepts behind big data problems, applications, and systems. The course offers familiarity with the Hadoop framework that simplifies big data analysis, making it more accessible. It covers the characteristics of Big Data, the process of structuring analysis, identification of big data problems, the architectural components, and programming models for scalable big data analysis. It also explores the core Hadoop stack components including the YARN resource and job management system, the HDFS file system, and the MapReduce programming model. Installations and virtual machine operations are required for hands-on assignments. Prior programming experience is not necessary.

Sub-Topic
Big Data: Why and Where
Characteristics of Big Data and Dimensions of Scalability
Data Science: Getting Value out of Big Data
Foundations for Big Data Systems and Programming
Systems: Getting Started with Hadoop

Formative Assessments:
6 quizzes and 1 peer-review assignment.

LEARNING OUTCOMES: On successful completion of the course the students shall be able to:

1. Understand and apply basic statistical measures to identify patterns within large sets of data,

2. Develop proficiency in recognizing various data characteristics, patterns, trends, deviations or inconsistencies, and potential outliers.
3. Employ techniques for dealing with big data like dimension reduction and feature selection methods.
4. Leverage advanced tools and charting libraries to improve the efficiency of big data analysis with partitioning and parallel analysis.
5. Visualize data using 2D and 3D formats achieving a better understanding and interpretation.
6. Get value out of Big Data following a specific 5-step process to structure your analysis.

PCAC2003 WEB AND APPLICATION DEVELOPMENT (3-0-0)

OVERALL COURSE OBJECTIVES: To enable learners to apply HTML5, CSS, Javascript, Git, GitHub, React, Node.js, and Express effectively in creating dynamic and interactive websites and web applications, understand and implement front-end and back-end development practices, effectively use version control for collaboration and demonstrate competencies in widely-used web technologies and server-side frameworks.

Module 1: Introduction to Web Development with HTML, CSS, JavaScript [13 Hours]

This starter course is designed for individuals aiming to become Web Developers, offering an introduction to the roles of front-end, back-end, and full-stack developers in development projects. It also familiarizes learners with the terminology and skills essential for a web development career. The focus is given to the languages needed for website or application development with a comprehensive understanding of HTML and CSS for creating the structure and style of websites. JavaScript is introduced to enable dynamic page features like interactive forms, dynamic content modification, and sophisticated menu systems. On completing this course, learners will be able to create a basic structure for a website, format and layout for web applications, enhance websites with rich, interactive applications, increase user interactivity and experience, and provide their websites with a unique appeal. Hands-on labs provide practical application opportunities, and a final portfolio-worthy project involves creating a webpage to showcase the skills learned.

Sub-Topic
Introduction to Application Development
CSS Overview & HTML5 Elements
HTML Overview
JavaScript Programming for Web Applications

Formative Assessments:
4 graded quizzes and 1 Peer-review assignment.

Module 2: Getting Started with Git and GitHub [18 Hours]

This self-paced introductory course provides an in-depth understanding of Git and GitHub, essential tools for collaboration and social coding in modern software engineering and DevOps culture. Starting with Git and GitHub fundamentals, it covers key Git concepts such as branching and repositories, along with the use of Git commands. The course includes hands-on labs, augmenting understanding of Git concepts including forking, cloning, and merging workflows, and fostering team productivity on GitHub. It concludes with a final project that allows students to begin building their portfolio with a public/open-source GitHub project, thus demonstrating their Git and GitHub skills and providing a valuable addition to their resume. All activities are browser-based, negating any need for specialized software installation on the learner's computer.

Sub-Topic
Git and GitHub Fundamentals
Using Git Commands and Managing GitHub Projects
Cloning and Forking GitHub Projects

Formative Assessments:
2 graded quizzes and 1 Peer-review assignment.

Module 3: Developing Front-End Apps with React [14 Hours]

This course provides comprehensive instruction on React, a popular framework for web and front-end application development. The curriculum includes building rich front-end applications with React and ES6, connecting React components using data and state, and writing advanced React components using Hooks and Redux. Learners will gain access to the React web framework UI library and learn to run rich React applications, modify their properties and states, and connect to an external server from a React page. The course also introduces various testing tools to verify components without manual checking. Hands-on labs and a final portfolio-worthy project form part of the course, demonstrating learners' acquired React skills. This course is beneficial for those looking to further their IT career as front-end or full-stack developers. Prior knowledge of HTML, CSS, JavaScript, and Git/GitHub is required.

Sub-Topic
Advanced React
Building Rich Front-End Applications with React and ES6
React Components
Introduction to TypeScript
Passing Data and States Between Components

Formative Assessments:
3 graded quizzes and 1 Peer-review assignment.

Module 4: Developing Back-End Apps with Node js and Express [12 Hours]

This course primarily focuses on Node.js and Express, two popular web technologies. Node.js, the most commonly used server-side technology, and Express, the most prevalent server-side web framework, are vital for developing modern web applications. In this course, you will concentrate on crafting applications using asynchronous callbacks and promises, creating REST APIs, and performing CRUD operations. You will also learn to implement authentication and session management. Ample hands-on labs provide practical experience, and a final project allows you to demonstrate your Node.js skills and add to your portfolio. This course equips you to thrive as a back-end or full-stack developer and is perfect for IT professionals aspiring for career advancement, new graduates looking to refine their server-side skills, and those managing cloud-centric projects. Prerequisites include knowledge of JavaScript and Git.

Sub-Topics
Introduction to Server-Side JavaScript
Asynchronous I/O with callback programming
Express Web Application Framework

Formative Assessments:
3 graded quizzes and 1 Peer-review assignment.

LEARNING OUTCOMES: On successful completion of the course the students shall be able to:

1. Demonstrate the fundamentals of HTML5, CSS, and JavaScript to create dynamic websites and web applications.

2. Utilize Git and GitHub for version control, collaboration, and social coding effectively in software engineering and DevOps practices.
3. Leverage React and ES6 to construct rich and interactive front-end applications with features like Hooks and Redux.
4. Design and manipulate dynamic user interfaces through React components, their properties, and states.
5. Develop back-end applications using Node.js and Express with features like asynchronous callbacks, REST APIs, CRUD operations, and session management.
6. Exhibit proficiency in server-side technologies, focusing on most popular server-side web framework- Express.

PCAR2004 CLOUD COMPUTING FOUNDATIONS (3-0-0)

OVERALL COURSE OBJECTIVES: The objective of this course is to enable learners to understand and analyze the fundamentals of cloud computing, its architecture, and emerging trends, and apply distributed computing concepts practically using relevant programming tools in the field, ultimately preparing them for potential career paths in cloud-based roles.

Module 1: Introduction to Cloud Computing [24 Hours]

This self-paced introductory course sets learners on a journey through the essentials of cloud computing. Appropriate for students, business professionals, and those considering a career switch, it covers vital characteristics of cloud computing, emergent technologies, service models including IaaS, PaaS, and SaaS, and deployment models like Public, Private, and Hybrid. Learners will explore the offerings of major cloud service providers, study case scenarios, and delve into topics like cloud adoption, blockchain, analytics, AI, and cloud computing architecture components. They will also become familiar with different types of cloud storage options and emergent cloud trends. The course concludes with students deploying an application to the cloud using serverless architecture as a final project, thus providing them with a beneficial portfolio addition.

Sub-Topics
Overview of Cloud Computing
Cloud Computing Models
Components of Cloud Computing
Emergent Trends and Practices
Cloud Security and Monitoring, Case Studies, and Jobs
Final Project and assignment

Formative Assessments:
5 quizzes and 1 peer-review assignment.

Module 2: Cloud Computing Concepts, Part 1 [23 Hours]

Cloud computing systems today, whether open-source or used inside companies, are built using a common set of core techniques, algorithms, and design philosophies – all centered around distributed systems. Learn about such fundamental distributed computing "concepts" for cloud computing.
Some of these concepts include: clouds, MapReduce, key-value/NoSQL stores, classical distributed algorithms, widely-used distributed algorithms, scalability, trending areas, and much, much more! Know how these systems work from the inside out. Get your hands dirty using these concepts with provided homework exercises. In the programming assignments, implement some of these concepts in template code (programs) provided in the C++ programming language. Prior experience with C++ is required. The course also features interviews with leading researchers and managers, from both industry and academia.

Sub-Topics
Gossip, Membership, and Grids
P2P Systems
Key-Value Stores, Time, and Ordering
Classical Distributed Algorithms

Formative Assessments:

6 quizzes, and 1 coding/lab assignments.

LEARNING OUTCOMES: On successful completion of the course the students shall be able to:

1. Understand the essential features and various service models of cloud computing along with the offerings of prominent market players.
2. Analyze different components of cloud computing architecture such as data centers, virtual machines, containers, and cloud storage options.
3. Demonstrate knowledge of emergent cloud trends such as DevOps, Hybrid and MultiCloud, and cloud security and monitoring.
4. Evaluate the applications of cloud computing in areas like blockchain, analytics, AI, and job roles in this field.
5. Develop competence in distributed computing concepts such as MapReduce, key-value/NoSQL stores, and scalability techniques used in cloud computing.
6. Apply these concepts practically to build or manipulate cloud systems using programming languages like C++.

PCAC2005 PROGRAMMING INTERNET OF THINGS (3-0-0)

OVERALL COURSE OBJECTIVES: To empower students with a comprehensive understanding of IoT and Embedded Systems, Arduino and Raspberry Pi platforms, and C and Python programming. This will enable them to create innovative IoT designs and products and understand how these devices interact with the physical world. They will also learn debugging techniques and network protocols essential for embedded systems.

Module 1: Introduction to the Internet of Things and Embedded Systems [12 Hours]

This course explores the significant role of the "Internet of Things" (IoT) in the modern world and its future trends. It defines what IoT and embedded systems are, describes their impact on society, and enumerates their components. The lessons cover hardware and software interactions in an IoT device and the role of an operating system in supporting this software. The course highlights key components of networking, including an understanding of how to connect devices to the Internet, the structure of the Internet, and the meaning of a "network protocol". It also explains Mobile Ad-Hoc Networks (MANETs) in relation to IoT. While beneficial, this course does not include discussion forums.

Sub-Topic
Embedded Systems
Hardware and Software
Networking and the Internet
What Is the Internet of Things (IoT)?

Formative Assessments:
4 quizzes and 4 peer-review assignments.

Module 2: The Arduino Platform and C Programming [13 Hours]

This course provides in-depth knowledge about the Arduino platform, including the physical board, libraries, and the integrated development environment (IDE). It explores the role and usage of shields and touches on programming the Arduino using C code. The lessons delve into elements like reading board schematics, installing the Arduino IDE, understanding the significance of libraries, and running a program. The course provides a comprehensive understanding of C variables, types, common operators, conditionals, loops, functions, and the implications of global variables. Additionally, the course covers the Arduino build process, the role of tools in the IDE, the structure of an Arduino sketch, and accessing pins on the Arduino. It also covers embedded software debugging, common debugging architectures for embedded systems, and the UART Serial communication protocol. The course does not include discussion forums.

Sub-Topic
Arduino Environment
Arduino Programs
C Programming
Basic C Operators
Arduino Sketches

Formative Assessments:
4 quizzes and 4 peer-review assignments.

Module 3: The Raspberry Pi Platform and Python Programming for the Raspberry Pi [19 Hours]

The Raspberry Pi is a small, affordable single-board computer that you will use to design and develop fun and practical IoT devices while learning programming and computer hardware. In addition, you will learn how to set up the Raspberry Pi environment, get a Linux operating system running, and write and execute some basic Python code on the Raspberry Pi. You will also learn how to use Python-based IDE (integrated development environments) for the Raspberry Pi and how to trace and debug Python code on the device.

Sub-Topic
Raspberry Pi Processor
Operating System Benefits
Raspberry Pi Configuration
Navigating the Filesystem
Linux Graphic User Interface
Python on Raspberry Pi

Formative Assessments:
4 quizzes and 4 peer-review assignments.

LEARNING OUTCOMES: On successful completion of the course the students shall be able to:

1. Understand and define the key concepts of “Internet of Things” and its impact on society, focusing specifically on design considerations and components of IoT devices.
2. Master the composition and firmware programming of the Arduino development board, as well as the usage of "shields" and libraries.
3. Gain the ability to compile and run a program using C language, understanding variables, types, and operators specifically relevant to Arduino sketches.
4. Acquire knowledge on the Raspberry Pi setup and operation, including executing a Linux operating system.
5. Develop expertise in writing and executing basic Python code on Raspberry Pi, also learning to use Python-based IDEs and debugging Python code.
6. Understand the fundamental aspects of networking, including network protocol, structure of the Internet, and their specific implications in IoT devices.

PCAC2006 ROBOTICS: MOTION PLANNING (3-0-0)

OVERALL COURSE OBJECTIVES: To develop a comprehensive understanding of robotics including aerial flight mechanics, computational motion planning, and their applications in the drone industry; achieve capabilities to build dynamic models, devise controllers, and navigate in complex environments using methods such as graph-based methods and artificial potential fields.

Module 1: Robotics: Aerial Robotics [18 Hours]

This course delves into the creation of agile micro aerial vehicles capable of operating autonomously in cluttered indoor and outdoor environments. It introduces the mechanics of flight and the design of quadrotor flying robots, enabling you to develop dynamic models, derive controllers, and synthesize planners for three-dimensional environments. Faced with the challenges of utilizing noisy sensors for localization and complex, three-dimensional maneuvering. The course presents real-world examples of the potential applications and challenges in the rapidly-growing drone industry. A familiarity with linear algebra, single-variable calculus, and differential equations, along with some experience programming with MATLAB or Octave, is recommended for those planning to take this course.

Sub-Topics
Key Components of Autonomous Flight
Unmanned Aerial Robotics (UAVs) and quadrotors
Design Considerations
Time, Motion, and Trajectories
Axis/Angle Representations for Rotations
Control of Multiple Robots

Formative Assessments:
5 quizzes and 5 Programming assignments.

Module 2: Robotics: Computational Motion Planning [11 Hours]

Robotic systems typically include three components: a mechanism which is capable of exerting forces and torques on the environment, a perception system for sensing the world and a decision and control system which modulates the robot's behavior to achieve the desired ends. In this course we will consider the problem of how a robot decides what to do to achieve its goals. This problem is often referred to as Motion Planning and it has been formulated in various ways to model different situations. You will learn some of the most common approaches to addressing this problem including graph-based methods, randomized planners and artificial potential fields. Throughout the course, we will discuss the aspects of the problem that make planning challenging.

Sub-Topics
Artificial Potential Field Methods
Configuration Space
Collision Detection and Freespace Sampling Methods
Graph-based Plan Methods
Sampling-based Planning Methods
Probabilistic Road Maps

Formative Assessments:

4 quizzes, and 6 coding/lab assignments.

LEARNING OUTCOMES: On successful completion of the course the students shall be able to:

1. Understand the mechanics of flight and the design of quadrotor flying robots for operation in 3D environments.
2. Develop dynamic models, derive controllers, and synthesize planners for drone operation.
3. Overcome challenges of using noisy sensors for localization and maneuvering in complex environments.
4. Familiarize with the components of robotic systems: mechanism, perception system, and decision and control system.
5. Grasp common approaches for motion planning in robotics including graph-based methods, randomized planners, and artificial potential fields.
6. Analyze real-world examples of the applications and challenges for the rapidly-growing drone industry.

PCAC2007 IT FUNDAMENTALS FOR CYBERSECURITY – I (3-0-0)

OVERALL COURSE OBJECTIVES: The objective of this course is to equip learners with a comprehensive understanding of Cybersecurity, from foundational knowledge and terminology to practical skills in system operations, role-based security processes, and advanced topics like encryption and compliance standards. This holistic view aims to prepare participants for junior-level analyst roles in the Cybersecurity field, ensuring they are well-versed in both theoretical and practical aspects of cyber defense.

Module 1 : Introduction to Cybersecurity Tools & Cyber Attacks [18 Hours]

This course gives you the background needed to understand basic Cybersecurity. You will learn the history of Cybersecurity, types and motives of cyber attacks to further your knowledge of current threats to organizations and individuals. Key terminology, basic system concepts and tools will be examined as an introduction to the Cybersecurity field. You will learn about critical thinking and its importance to anyone looking to pursue a career in Cybersecurity.

Sub-Topics
A brief overview of types of actors and their motives
An overview of key security concepts
An overview of key security tools
History of Cybersecurity

Formative Assessments:
4 Graded Quizzes

Module 2 : Cybersecurity Roles, Processes & Operating System Security [15 Hours]

This course gives you the background needed to understand basic cybersecurity around people. process and technology. You will understand the key cybersecurity roles within an organization; list key cybersecurity processes and an example of each process; describe the architecture, file systems, and basic commands for multiple operating systems including Windows, Mac/OS, Linux, and Mobile; and also understand the concept of virtualization as it relates to cybersecurity.

Sub-Topics
Authentication and Access Control
Examples & Principles of the CIA Triad
Linux Operating System Security Basics
macOS Security Basics
Overview of Virtualization
People Process & Technology
Windows Operating System Security Basics

Formative Assessments:
6 Graded Quizzes

Module 3 : Cybersecurity Compliance Framework & System Administration [21 Hours]

This course gives you the background needed to understand the key cybersecurity compliance and industry standards. This knowledge will be important for you to learn no matter what cybersecurity role you would like to acquire or have within an organization.

You will learn the basic commands for user and server administration as it relates to security. You will need this skill to be able to understand vulnerabilities within your organizations operating systems.

Sub-Topics
Client System Administration, Endpoint Protection and Patching
Compliance Frameworks and Industry Standards
Cryptography and Compliance Pitfalls
Linux and Encryption: Final Project
Server and User Administration

Formative Assessments:
4 Graded Quizzes

LEARNING OUTCOMES: On successful completion of the course the students shall be able to:

1. Understand basic Cybersecurity concepts, gaining foundational knowledge of the Cybersecurity landscape including types, motives of cyber attacks, and the history behind them.
2. Grasp key Cybersecurity terminology and tools, learning essential terms and introductory tools relevant to Cybersecurity, facilitating a deeper understanding of system concepts.
3. Recognize the key roles and typical processes within a Cybersecurity organization, enhancing comprehension of operational security.
4. Develop skills to navigate and manage Windows, MacOS, Linux, and mobile operating systems from a security perspective.
5. Understand and apply cybersecurity compliance standards and protocols to maintain the integrity and security of information systems.
6. Learn fundamental concepts and practices of cryptography and encryption, crucial for protecting information against cyber threats.

PCAC2201 PYTHON PROGRAMMING LAB. (0-0-3)

List of lab/practical assignments:

Module Title	Lab Name	Details
Programming for Everybody (Getting Started with Python)	Python Code Playground	Write any code in the Python playground, referring the three sample files loaded and ready
	Installing Python Screen Shots	Install Python and a programming text editor and write a program that prints one line other than 'hello world', then take two screenshots and upload them. You should use the command line to execute the Python program you wrote in the text editor.
	Write Hello World	Write a program that uses a print function to say 'hello world' as shown in 'Desired Output'.
	Print	Write a program that uses input to prompt a user for their name and then welcomes them
	Input, Float	Write a program that uses input to prompt a user for their name and then welcomes them
	Compute gross pay	Write a program to prompt the user for hours and rate per hour using input to compute gross pay. Pay the hourly rate for the hours up to 40 and 1.5 times the hourly rate for all hours worked above 40 hours. Use 45 hours and a rate of 10.50 per hour to test the program (the pay should be 498.75). You should use input to read a string and float() to convert the string to a number.
	Scoring/ Grading	Write a program to prompt for a score between 0.0 and 1.0. If the score is out of range, print an error. If the score is between 0.0 and 1.0, print a grade
	Compute gross pay	Write a program to prompt the user for hours and rate per hour using input to compute gross pay.
	Largest/smallest number	Write a program that repeatedly prompts a user for integer numbers until the user enters 'done'. Once 'done' is entered, print out the largest and smallest of the numbers.
Python Data Structures	Find function	Write code using find() and string slicing (see section 6.10) to extract the number at the end of the line below. Convert the extracted value to a floating point number and print it out.

	File processing	Write any code using the three files loaded: "mbox-short.txt", "romeo.txt", and "words.txt".
		Write a program that prompts for a file name, then opens that file and reads through the file, and print the contents of the file in upper case.
		Write a program that prompts for a file name, then opens that file and reads through the file, looking for lines of the form: X-DSPAM-Confidence: 0.8475 Count these lines and extract the floating point values from each of the lines and compute the average of those values and produce an output as shown
	Lists	Open the file romeo.txt and read it line by line. For each line, split the line into a list of words using the split() method.
		Open the file mbox-short.txt and read it line by line. When you find a line that starts with 'From ', find and print out the second word in the line
	Dictionary	Write a program to read through the mbox-short.txt and figure out who has sent the greatest number of mail messages.
	Tuples	Write a program to read through the mbox-short.txt and figure out the distribution by hour of the day for each of the messages.
Using Python to Access Web Data	Installing and Running Python Screen Shots	Install Python and a programming text editor and write a program that prints one line other than 'hello world
	Extracting Data With Regular Expressions	Read through and parse a file with text and numbers. You will extract all the numbers in the file and compute the sum of the numbers.
	Understanding the Request / Response Cycle	Write a Python program to retrieve a web page over a socket and display the headers from the web server.
	Scraping HTML Data with BeautifulSoup	Write a Python program to use urllib to read the HTML from the data files below, and parse the data, extracting numbers and compute the sum of the numbers in the file

	Following Links in HTML Using BeautifulSoup	Write a Python program that will use urllib to read the HTML from the data files below, extract the href= values from the anchor tags, scan for a tag that is in a particular position from the top and follow that link, repeat the process a number of times, and report the last name you find.
	Extracting Data from XML	Write a Python program that will prompt for a URL, read the XML data from that URL using urllib and then parse and extract the comment counts from the XML data, compute the sum of the numbers in the file and enter the sum
	Extracting Data from JSON	The program will prompt for a URL, read the JSON data from that URL using urllib and then parse and extract the comment counts from the JSON data, compute the sum of the numbers in the file.
	Using a Geo Location API	Use a Geo Location lookup API to look up the location of some universities and parse the returned data.

PCAC2202 DATA SCIENCE FOUNDATIONS LAB. (0-0-3)

Module Title	Lab Name	Details
Introduction to Data Science in Python	Fundamentals of Data Manipulation	Find a list of all of all of the names in the following string using regex The dataset file in assets/grades.txt contains a line separated list of people with their grade in a class. Create a regex to generate a list of just those students who received a B in the course. Consider the standard web log file in assets/logdata.txt. Your task is to convert this into a list of dictionaries
	Basic Data Processing with Pandas	Look at 2017 data on immunizations from the CDC. Write a function called proportion_of_education which returns the proportion of children in the dataset who had a mother with the education levels equal to less than high school (<12), high school (12), more than high school but not a college graduate (>12) and college degree. explore the relationship between being fed breastmilk as a child and getting a seasonal influenza vaccine from a healthcare provider. see if there is any evidence of a link between vaccine effectiveness and sex of the child. Calculate the ratio of the number of children who contracted chickenpox but were vaccinated against it (at least one varicella dose) versus those who were vaccinated but did not contract chicken pox. Return results by sex.
	More Data Manipulation with Pandas	Load the energy data from the file assets/Energy Indicators.xls, which is a list of indicators of energy supply and renewable electricity production from the United Nations for the year 2013, and should be put into a DataFrame with the variable name of Energy. Answer questions like: What are the top 15 countries for average GDP over the last 10 years? By how much had the GDP changed over the 10 year span for the country with the 6th largest average GDP?
	Beyond Data Manipulation	Read in a file of metropolitan regions and associated sports teams from assets/wikipedia_data.html and answer some questions about each metropolitan region. calculate the win/loss ratio's correlation with the population of the city it is in for the NHL using 2018 data. calculate the win/loss ratio's correlation with the population of the city it is in for the NBA using 2018

		data. calculate the win/loss ratio's correlation with the population of the city it is in for the MLB using 2018 data. calculate the win/loss ratio's correlation with the population of the city it is in for the NFL using 2018 data. explore the hypothesis that given that an area has two sports teams in different sports, those teams will perform the same within their respective sports.
Introduction to Big Data	Understand by Doing: MapReduce	Perform the steps of MapReduce to calculate a count of the number of squares, stars, circles, hearts and triangles in the dataset shown in the picture, following the steps of MapReduce

PCAC2203 WEB AND APPLICATION DEVELOPMENT LAB. (0-0-3)

Module Title	Lab Name	Details
Introduction to Web Development with HTML, CSS, JavaScript	Intro to HTML (JSFiddle)	In this lab, we will explore all the components of an HTML file viz, HTML markup, CSS styling and JavaScript code.
	HTML - Creating a Simple Web Page	In this lab assume you are a web developer who has been approached by the fan club for IBM founder, Thomas J. Watson Sr., to create a web page for them.
	Unit Conversion using HTML5 Structural Elements	In this lab, you will be creating a simple web page Unit Converter application that converts metric units to imperial units. The page will be divided into three sections, each of which will do one of the following: Convert temperature from Celcius to Fahrenheit Convert weight from Kilograms to Pounds Convert distance from Kilometers to Miles
	CSS Basics - Styling Your Web Page	You are a web developer and have been asked by a primary school to develop a web page on the solar system. Objectives After completing this lab, you will be able to: Create a basic webpage Specify the font family and font size for text Use colors to change the appearance of elements Create borders

	JavaScript	JavaScript is a client-side scripting language and is commonly used to create dynamic web pages. It helps in changing web page contents dynamically, validating forms, etc. In this lab, we will create an HTML form that uses JavaScript to validate the user input.
	Javascript - Browser Console	The purpose of this lab is to practice using JavaScript in the browser console, to reinforce your understanding of certain concepts.
	Simple Interest Calculator	Simple Interest Calculator, to enhance your learning experience. Modify the HTML file as per the requirements. Modify the CSS file as per the requirements. Modify the JavaScript file as per the requirements. Verify that the webpage is working properly.
	Single Page Portfolio Website	In this project you will be creating a single page Portfolio website using HTML5, CSS & JavaScript having the following sections: About Me Skills Projects Recommendations
	Publish your Portfolio to Github Pages	In this lab, you will publish the portfolio page to Github Pages. GitHub Pages is a static site hosting service that takes HTML, CSS, and JavaScript files straight from a repository on GitHub, optionally runs the files through a build process, and publishes a website.
Getting Started with Git and GitHub	GitHub Sign Up and Create Repo	In this lab, you will get started with GitHub by creating a GitHub account and creating a new repository. You will then add a file to the repository using

		the GitHub web interface.
	Getting Started with Branches using Git Commands	You would typically use Git commands from your own desktop/laptop. However, so you can get started using the commands quickly without having to download or install anything, we are providing an IDE with a Terminal on the Cloud. Simply click the "Launch App" below to launch the Skills Network Cloud IDE and in the new browser tab that launches, follow the instructions to practice the Git commands. After completing this lab you will be able to use git commands to start working with creating and managing your code branches
	Cloning and Forking GitHub Projects	After completing this lab you will be able to use git commands to manage upstream repositories: fork existing repository using the UI clone forked repository in the lab environment create a new branch make changes locally add and commit to local branch push changes to your forked repository create a pull request to the upstream repository
	Practice Project: Overview	Assignment involves harnessing GitHub's collaborative and version control features to oversee the development and deployment of the shipping calculator web application. This initiative aims to lead to an optimized supply chain management process.

	Practice Project: Part 1 - GitHub UI	In this lab you will start your journey with the GitHub implemention for your organisation by creating a repository in your GitHub account and then initialising the repository with a README.md file and a License. Following this, you'll update the README file to include a Code of Conduct and Contribution Guidelines markdown files. After making these changes, you'll commit the files to your repository.
	Practice Project: Part 2 - Git CLI	All the developers have contributed to the repository, and their changes have been accepted and merged into a new global repository. Now, you have been asked to edit some of the code and also add few more files. For this, you will fork this repository, make the necessary edits, add files using Git CLI in the provided lab environment, and open a pull request.
	Final Project: Part 1 - GitHub UI	After completing this lab, you would have demonstrated that you can: Create a new repository in your GitHub account. Select the appropriate license for your project. Create a README.md file that explains the purpose of the project. Create a Code of Conduct markdown that explains how you want the community to behave and interact with each other. Create a Contribution Guidelines markdown that tells the community how to contribute. Commit the new files to the repository.

Developing Front-End Apps with React	Lab: Content Rating Application to Like or Dislike Content	In this lab, you will create a React component called 'ContentRating' where the component will let users rate material by clicking 'like' or 'dislike' buttons. When the component is rendered for the first time, both the like and dislike counts are set to zero. You will create a method that changes the state to add one to the number of likes when a user selects the 'like' button. In the same way, clicking the 'dislike' button, the method will add one to the number of dislikes. This action lets users rate the content in an interactive way and provides useful input to content creators.
	Lab: Function Component Event Planner Landing Page	In this lab, you are going to create a landing page for an organization that plans personal and corporate events. You will create the EventPlanner component that consists of various sections, such as the description of the application, event categories, features, testimonials, contact form, and footer. Each section describes various aspects of the Event Planner app, such as the types of events that can be planned, the app's main features, customer reviews, and how to get in touch with the service provider.
	Lab: Fetch Data Using useFetch	In this lab, you will learn how to fetch data in React using a custom hook (UseFetch) and a corresponding component (FetchData). By encapsulating data-fetching logic into reusable hooks, you can improve code maintainability. You will master React's useState and useEffect hooks for managing state and asynchronous operations efficiently. Additionally, you learn to dynamically render fetched data on the UI with JSX, enabling the creation of dynamic and interactive components.

	Lab: Create Feedback Form for Survey	In this lab, you will create a feedback form using React functional components and manage user details using the useState hook. You will implement event handlers to manage form input changes, validate user inputs, and handle form submissions. Additionally, you will create a confirmation dialog using the confirm method to confirm user details before final submission. Upon successful submission, you will reset the form fields and display a thank you message to the user. This lab will give you practical experience building interactive forms and handling user inputs in React applications.
	Practice Project: Conference Event Planner	The application's requirements include allowing users to select and price the rooms in the conference center, add-on selections, like microphones and projectors, and meals for a given number of guests.
Developing Back-End Apps with Node js and Express	First Server with ServerSide Java Script	Objective for Exercise: Use the terminal to git clone and get Node.JS server code Create a web server using Server side Java script Run the server Access the server from the client and get a response from server
	Promises and Call Back	After completing this lab, you will be able to: Describe Promise callbacks Create a Node.js application with promises
	Async Callback Programing	By the end of this lab, you will be able to understand asynchronous callbacks and be able to write the code in a Node.js application.

	CRUD Operations with Node.js and Express	In this lab you will learn how to create a Friend's list using Express server. Your application should allow you to add a friend with the following details: First name, Last name, Email and Date of birth. You will also be providing the application the ability to retrieve details, change details and delete the details. You will be creating an application with API endpoints to perform Create, Retrieve, Update and Delete operations on the above data using an Express server. You will also learn to provide authenticated access to the endpoints. You will use cURL and Postman to test the implemented endpoints.
	Express Server	Objective for Exercise: Create express server and run it Work on Middlewares with Express server Use middleware and JWT for authentication Render a static HTML page through express server
	Friends List Application Using Express Server with JWT	In the CRUD lab you performed CRUD operations on transient data by creating API endpoints with an Express Server. In this lab, you will restrict these operations to authenticated users using JWT and session authentication. In this lab, the friends object will be a JSON/dictionary with email as the key and friends object as the value. The friends object is a dictionary with firstName,lastName, DOB mapped to their respective values. You will thus be using “body” from the HTTP

		request instead of “query” and “params”. Only authenticated users will be able to perform all the CRUD operations. We will be testing the output of the endpoints on Postman.
	Book Review Application	In this final project, we will build a server-side online book review application and integrate it with a secure REST API server which will use authentication at session level using JWT. You will then test your application using Promises callbacks or Async-Await functions.

PCAC2204 CLOUD COMPUTING FOUNDATION LAB. (0-0-3)

Module Title	Lab Name	Details
Introduction to Cloud Computing	Obtain IBM Cloud Feature Code and Activate Trial Account	To facilitate hands-on skills development and enable you to complete some of the labs in this course, we are providing you with a special Feature Code that will enable you to create an IBM Cloud Trial Account. This feature code will enable you to either create an IBM Cloud trial account without a credit card. Please check the box and click on the "Open tool" button below to get a unique Feature Code to activate your IBM Cloud trial account.
	Deploy an Application on Cloud	In this hands-on lab you will build a docker container image, upload it to IBM Cloud Container Registry, and deploy an application on cloud using a serverless technology called IBM Code Engine! No programming knowledge required. Simply follow the step-by-step instructions and copy and execute the commands provided in the cloud-based lab environment from within your web-browser.
Cloud Computing Concepts, Part 1	Programming Assignment	By completing this programming assignment, you will be able to: Design, implement, and test your distributed failure detection protocol. Design, implement, and test your distributed membership protocol.
	Update notes for Gossip Protocol submission	We've made some system compatibility updates to the Gossip Protocol submission scripts. Before you try to submit your Gossip Protocol assignment, please download the attached file and extract it. Inside, you will find these files: mp1-regen-data

		run.sh submit.py

PCAC2205 PROGRAMMING INTERNET OF THINGS LAB. (0-0-3)

Module Title	Lab Name	Details
Introduction to the Internet of Things and Embedded Systems	Wireshark	Download and install Wireshark on a computer. Start Wireshark and start a packet capture. Open a browser on your computer and go to any webpage. Stop the Wireshark packet capture and examine it to find the first TCP packet which is recorded and whose source is your computer. Find the port number, P, used on your computer. Use the Wireshark filter to show only the messages to/from this port (tcp.port == P). Select the message and make sure that the Packet Details Pane is visible and showing the following information: 1) the Internet Protocol header with the Src and Dst IP addresses, and 2) the Transmission Control Protocol header with the Src Port number and Dst Port numbers. Print the screen image and submit it for grading. Also, submit one page which states your machine's IP address at the time of capture, and the port number that you found being used for the TCP connection on your computer.
The Arduino Platform and C Programming	Install Arduino IDE	install the Arduino IDE on your computer, compile the "Blink" example, upload the example to the board, and ensure that the LED blinks.
	Program to compute Fibonacci sequence	Write a program in C that computes and prints out the first six digits in the Fibonacci sequence.
	Arduino Blink	Write a program that causes the built-in LED connected to pin 13 on the Arduino to blink, alternating between fast blinks and slow blinks. The LED should blink 5 times quickly and then it should blink 5 more times slowly. The LED should continue to blink in this alternating fashion for as long as the Arduino receives power.
	Serial on Arduino	Write a program that allows the user to control the LED connected to pin 13 of the Arduino. When the program is started, the LED should be off. The user should open the serial monitor to communicate with the Arduino. If the user sends the character '1' through the serial monitor then the LED should turn on. If the user sends the character '0' through the serial monitor then the LED should turn off.
The Raspberry Pi	Raspberry Pi setup	Setup your Raspberry Pi by usingNOOBSto install Raspbian on the micro SD card. Boot your Raspberry Pi

Platform and Python Programming for the Raspberry Pi		to the desktop and take a picture (with a regular camera/phone) of the desktop. Submit the picture as evidence that you completed the task.
		Boot the Raspberry Pi and install the “scrot” program to take screen shots. You can install it by typing “sudo apt-get install scrot” in a terminal window. Use the scrot program to take a screenshot of your Raspberry Pi.
	Use Python shell	Write a Python program that prompts the user to input 3 numbers, one at a time. The Python program should put the numbers in a list, sort the list, and print the sorted list.
	Circuit using Raspberry Pi	Build a circuit using your Raspberry Pi that causes an LED to blink when a push button is NOT pressed. However, the LED should stay on continually when the push button IS pressed. Your video should show the LED blinking when the push button is not pressed, and it should show that the LED is constantly on while the button is pressed.

PCAC2206 ROBOTICS : MOTION PLANNING LAB. (0-0-3)

Module Title	Lab Name	Details
Robotics: Aerial Robotics	1-D Quadrotor Control	Get started with a 1D quadrotor simulator and and implement a controller for it. We will be testing your controller with two cases. In the first test case, the quadrotor simply needs to stabilize at a height of 0. The second test case gives the quadrotor a step input of 1 meter; that is, your quadrotor will be asked to rise to a height of 1 meter.
	2-D Quadrotor Control	Design and implement a controller for a planar (2D) quadrotor. We will be testing your controller with two trajectories, the first one is a horizontal line trajectory and the second one is a more complex sine wave shaped trajectory.
	3-D Quadrotor Control	Extend the controller you developed earlier for a full 3D quadrotor. In addition, you will write a trajectory generator which outputs time parameterized trajectories which allow a quadrotor to fly through a given set of waypoints.
Robotics: Computational Motion Planning	MATLAB Practice	MATLAB Grader: write a function to create a rotation matrix to show how to complete programming assignments.
	Dijkstra Problem	Write Matlab code to implement the Dijkstra planning algorithm that works on 2D grid like environments.
	A Star Algorithm	Write Matlab code to implement the A-star planning algorithm that works on 2D grid-like environments.
	Configuration space	Write a program to help guide a two link robotic arm from one configuration to another while avoiding obstacles in the workspace.
	Random Sampling Approaches	Write a program to help guide the six link robot shown in the figure from one configuration to another while avoiding the objects in the workspace.
	Gradient based planner	Develop a code to guide a robot from one location to another in a 2-dimensional configuration space using artificial potential fields.

PCAC2207 IT FUNDAMENTALS FOR CYBERSECURITY - I LAB. (0-0-3)

Module Title	Lab Name	Details
Introduction to Cybersecurity Tools & Cyberattacks	Hands-on Lab: Malware Scan Using Rkhunter	After completing this lab, you will be able to: Install rkhunter on a Linux system Run a malware scan to check for rootkits and malware
Operating Systems: Overview, Administration, and Security	Using File Explorer to Manage Files and Folders	n this hand-on lab, you will: Employ Microsoft Windows File Explorer for file and folder navigation Construct a new folder called “Office files” Use LibreOffice to create a new document and to add text to that document Use the “Office files” folder structure as the LibreOffice document file location Identify the stored path of the new Project 1 document
	Exploring Microsoft Windows Server Features	After completing this lab, you will be able to: Open and work with the Server Manager management console Access remote, multi-server management
	Using Microsoft Windows Command Prompt Tools for Administration	In this hands-on lab, you will: Obtain system information using the command line. Manage directories using the command line. Perform system maintenance using the command line.
	Creating Windows Users and Groups	In this lab you will familiarize yourself with Windows User Account creation on the Windows Server using the Server Manager.
	Windows Defender Firewall	In this lab, you will learn to: Configure the Windows Defender Firewall using the basic user interface.
	Creating a Firewall Rule in Microsoft Windows Defender	In this hands-on lab, you will: Use Windows Defender Firewall with Advanced Security to edit an existing firewall rule. Enforce the following rules: – Allow the connection for Key Management Service on

		the Domain and Private network. – Allow the connection for Key Management Service on the Public network.
	Getting Started with Linux Terminal	In this lab, you will Interact with the Linux Terminal, navigate directories on a Linux filesystem and explore their contents, install and update packages, create and edit files using `nano`, execute shell commands and applications from the terminal.
	Common Linux/Unix Commands	In this lab, you will be introduced to the use basic Unix commands related to the following categories: General purpose commands. Directory management commands. File management commands. Access control commands. Text processing commands. Networking commands.
	Linux User Management	In this lab you will learn how to do create users, create groups and add user to groups within Kali Linux. Kali Linux is a well-known, open-source Linux operating system built on the Debian platform. It's tailored for professionals and learners in the field of cybersecurity and is purposefully crafted for tasks like penetration testing and ethical hacking.
	Updating Linux	After completing this lab, you will know how to: Update package lists Perform Linux system upgrade
	Getting Started with Linux Terminal	In this lab, you will Interact with the Linux Terminal, navigate directories on a Linux filesystem and explore their contents, install and update packages, create and edit files using `nano`, execute shell commands and applications from the terminal.
	Common Linux/Unix Commands	In this lab you will practice working with commonly used Linux commands for directory management, file management, access control, text processing, and networking .
	Linux User Management	In this lab, you will practice working with commonly used Linux commands for user management.
	Updating Linux	In this lab, you will perform important updates needed

		to secure Linux systems.
	Introduction to Containers, Docker and IBM Cloud Container Registry	This lab will demonstrate how to pull an image from Docker Hub and run an image as a container using docker, and build an image using a Dockerfile and push an image to IBM Cloud Container Registry.
	Final Project Part 1: Windows	After completing this project, you will have demonstrated your ability to Create a new user and a new group using Windows Server Manager Add a user to a group using Windows Server Manager Check for updates to virus and threat protection using a Windows operating system Run a "Quick Scan" to verify up-to-date virus and threat protection on a Windows operating system Create an inbound rule that controls connections on a TCP port using Windows Defender Firewall
	Final Project Part 2: Linux Tasks	After completing this project, you will have demonstrated your ability to Create a new user on a Linux operating system Manage files and directories on a Linux operating system Apply system updates on a Linux operating system

BACHELOR OF TECHNOLOGY
MECHANICAL ENGINEERING
SECOND YEAR (FOURTH SEMESTER)

W.E.F. ADMISSION BATCH 2023-24

Sl. No.	Category	Course Code	Course	Contact Hrs. L-T-P	Credit	University Marks	Internal Evaluation
Subject (Theory)							
1	PC	MEPC2006	Basic Manufacturing Processes	3-0-0	3	100	50
2	PC	MEPC2003	Fluid Mechanics and Hydraulic Machines	3-0-0	3	100	50
3	PC	MEPC2004	Kinematics and Dynamics of Machines	3-0-0	3	100	50
4	PC	MEPC2005	Design of Machine Elements-I	3-0-0	3	100	50
5	PC(ACC)	PCAC2008	Machine Learning Techniques and Applications	3-0-0	2	100	50
		PCAC2009	Big Data Integration and Management				
		PCAC2010	Application Development - Tools & Technologies				
		PCAC2011	Cloud Infrastructure & Applications				
		PCAC2012	Internet of Things and Cloud				
		PCAC2013	Robotics : Mobility & Design				
		PCAC2014	IT Fundamentals for Cybersecurity - II				
6	HS	HSHS2002	Organizational Behaviour	3-0-0	2	100	50
		HSHS2001	Engineering Economics				
Subject (Sessional / Practical)							
7	PC	MEPC2205	Basic Manufacturing Processes Lab.	0-0-3	1.5	-	100
8	PC	MEPC2206	Fluid Mechanics and Fluid Machinery Laboratory	0-0-3	1.5	-	100
9	PC	MEPC2207	Machines and Mechanisms Lab.	0-0-3	1.5	-	100
10	PC	MEPC2208	Design of Machine Elements-I Lab.	0-0-3	1.5	-	100
			Total	**18-0-12**	**22**	**600**	**700**

Note : Minimum four (04) weeks of Summer Course / Training / Internship / Skill Course / etc. after 4th Semester.

Click here to view/download the syllabus of the subjects.

PCAC2014 IT Fundamentals for Cybersecurity – II (3-0-0)

OVERALL COURSE OBJECTIVES: The objective of this course series is to provide a robust foundation in cybersecurity, emphasizing practical skills in network and database security, the application of generative AI tools in cybersecurity challenges, and detailed methodologies in penetration testing and incident response. This comprehensive approach is designed to prepare students for advanced roles in the cybersecurity field, ensuring they can effectively address and mitigate potential security threats.

LEARNING OUTCOMES: On successful completion of the course the students shall be able to:

Gain knowledge of Local Area Networks, TCP/IP, the OSI Framework, and routing basics, and comprehend how networking affects security systems within an organization.

Learn about common vulnerabilities in various databases including SQL, Oracle, Mongo, and Couch, and apply knowledge to mitigate risks such as SQL Injection.

Apply generative AI tools to combat cyber threats by detecting vulnerabilities and automating the creation of cybersecurity content like playbooks and threat intelligence reports.

Develop skills to perform penetration testing using various tools, gather essential data, and understand the phases of testing to improve organizational security.

Understand the phases of incident response, from planning and preparation to documentation and recovery, and develop skills in managing and responding to security breaches effectively.

Learn key forensic processes and the collection of important digital evidence, enhancing capabilities in analyzing and responding to cybersecurity incidents.

COURSE CONTENT:

Module 1: Network Security & Database Vulnerabilities [18 Hours]

This course gives you the background needed to understand basic network security. You will learn the about Local Area Networks, TCP/IP, the OSI Framework and routing basics. You will learn how networking affects security systems within an organization. You will learn the network components that guard an organization from cybersecurity attacks.

In addition to networking, you will learn about database vulnerabilities and the tools/knowledge needed to research a database vulnerability for a variety of databases including SQL Injection, Oracle, Mongo and Couch.

Sub-Topics
Basics of IP Addressing and the OSI Model
Deep Dive - Injection Vulnerability
Final Project
Introduction to Databases
TCP/IP Framework

Formative Assessments:
4 Graded Quizzes & 1 Peer Review Assignment

Module 2: Generative AI: Boost Your Cybersecurity Career [10 Hours]

This short course provides cybersecurity professionals and enthusiasts with the latest Generative AI tools to address complex cybersecurity challenges.

The course focuses on combating the exploitation of undetected vulnerabilities for which organizations increasingly turn to Artificial Intelligence (AI) and Machine Learning (ML). Generative AI, a transformative technology, emerges as a vital cybersecurity tool, detecting and preventing attacks by identifying and neutralizing unknown vulnerabilities before causing significant harm.

The course explores foundational generative AI principles and their application in real-world cybersecurity, encompassing User and Entity Behavior Analytics (UEBA), threat intelligence, report summarization, playbooks, and its impact on phishing, malware, misinformation, and deepfakes. Additionally, participants learn about potential Natural Language Processing (NLP) attack techniques, like prompt injection, and strategies to mitigate them.

Sub-Topics
Final Project and Exam
Get Started with Gen AI in Cybersecurity
SIEM and SOC Tasks Using Generative AI

Formative Assessments:
3 Staff Graded Assessments

Module 3: Penetration Testing, Incident Response and Forensics [16 Hours]

This course gives you the background needed to gain Cybersecurity skills as part of the Cybersecurity Security Analyst Professional Certificate program.

You will learn about the different phases of penetration testing, how to gather data for your penetration test and popular penetration testing tools. Furthermore, you will learn the phases of an incident response, important documentation to collect, and the components of an incident response policy and team. Finally, you will learn key steps in the forensic process and important data to collect. This course also gives you a first look at scripting and the importance to a system analyst.

Sub-Topics
Digital Forensics
Incident Response
Introduction to Scripting
Penetration Testing

Formative Assessments:
4 Graded Quizzes

ASSESSMENT:
For summative assessments, Coursera will provide question banks for which exams can be conducted on the Coursera platform or the faculty will create their own assessments.

Note: If a Course or Specialization becomes unavailable prior to the end of the Term, Coursera may replace such Course or Specialization with a reasonable alternative Course or Specialization.

PCAC2013 ROBOTICS : MOBILITY & DESIGN (3-0-0)

OVERALL COURSE OBJECTIVES: To develop a comprehensive understanding of robotic mobility and perception, by learning to design efficient robotic bodies, implementing concepts of kinematics and dynamics, developing sensorimotor programs, and utilizing visual and sensory information for manipulation and navigation tasks.

LEARNING OUTCOMES: On successful completion of the course the students shall be able to:

Understand how to design robotic bodies and behaviors for efficient and reliable mobility in a dynamic world.

Apply the concept of kinematics and dynamics in designing legged machines and robots.

Develop sensorimotor programs through simple dynamical abstractions.

Comprehend the transformation process of images and videos into 2D representations for efficient grasping and navigation.

Identify the calculation of 3D posing of objects to facilitate manipulation tasks.

Comprehend visual odometry and landmark-based localization for effective navigation.

COURSE CONTENT:

Module 1: Robotics: Mobility [19 Hours]

How can robots use their motors and sensors to move around in an unstructured environment? You will understand how to design robot bodies and behaviors that recruit limbs and more general appendages to apply physical forces that confer reliable mobility in a complex and dynamic world. We develop an approach to composing simple dynamical abstractions that partially automate the generation of complicated sensorimotor programs. Specific topics that will be covered include: mobility in animals and robots, kinematics and dynamics of legged machines, and design of dynamical behavior via energy landscapes.

Sub-Topics
Anchors: Embodied Behaviors
Behavioral (Templates) & Physical (Bodies)
Composition (Programming Work)

Formative Assessments:
23 quizzes

Module 2: Robotics: Perception [33 Hours]

How can robots perceive the world and their own movements so that they accomplish navigation and manipulation tasks? In this module, we will study how images and videos acquired by cameras mounted on robots are transformed into representations like features and optical flow. Such 2D representations allow us then to extract 3D information about where the camera is and in which direction the robot moves. You will come to understand how grasping objects is facilitated by the computation of 3D posing of objects and navigation can be accomplished by visual odometry and landmark-based localization.

Sub-Topics
Geometry of Image Formation
Glimpse on Vanishing Points
Rotations and Translations
Multi-View Geometry
Pose Estimation
RANSAC: Random Sample Consensus
Projective Transformations

Formative Assessments:
20 quizzes and 4 coding/lab assignments.

ASSESSMENT:

For summative assessments, Coursera will provide question banks for which exams can be conducted on the Coursera platform or the faculty will create their own assessments.

Note: If a Course or Specialization becomes unavailable prior to the end of the Term, Coursera may replace such Course or Specialization with a reasonable alternative Course or Specialization.

PCAC2012 INTERNET OF THINGS AND CLOUD (3-0-0)

OVERALL COURSE OBJECTIVES: To provide learners with an in-depth understanding of the evolution of Internet of Things and related technologies, equip them with the skills to utilize advanced technology platforms like DragonBoard™ and AWS, and allow them to apply these skills in developing innovative IoT-enabled applications and systems.

LEARNING OUTCOMES: On successful completion of the course the students shall be able to:

Understand, compare, and explain how telephony and media delivery networks operate.

Understand circuit switched networks and packet switched networks and their trade-offs.

Comprehend key innovations that have transformed the communication, entertainment, and consumer electronics industry.

Describe the DragonBoard™ 410c peripherals, I/O expansion capabilities, computing capabilities, and connectivity capabilities.

Use Linux terminal for embedded purposes and configure integrated development environment (IDE) for software development.

Understand and utilize various AWS cloud services such as EC2, IoT and more, to build and integrate projects that leverage the cloud.

COURSE CONTENT:

Module 1: Internet of Things: How did we get here? [21 Hours]

This course explores the convergence of multiple disciplines that have led to the advent of present-day smartphones and the Internet of Things. The lessons explore the evolution of telephony networks, broadcast networks, and consumer electronics, along with the impact of the internet, multimedia content, smartphones, and apps. It also covers the emerging, interconnected platform: the Internet of Things. Upon completion, learners will understand how peer-to-peer networks differ from broadcast networks, the tradeoffs between circuit-switched and packet-switched networks, and the workings of several key innovations and digital services. The course provides an important grounding for anyone interested in the technological development of the Internet of Things, and further resources for a more in-depth exploration of the topics.

Sub-Topics
Circuit Switched Networks
Computer Telephony
Features and Apps
Future Outlook
Packet Switched Networks
Wireless Technologies

Formative Assessments:
16 quizzes.

Module 2: Internet of Things V2: DragonBoard™ bring up and community ecosystem [21 Hours]

This course is designed for individuals seeking to develop the skills needed to prototype embedded products using advanced technologies. The course utilizes the DragonBoard™ 410c single board computer (SBC) to provide a hardware and software development environment for Internet of Things specialization courses. Ideal for learners interested in using Linux for embedded purposes, pursuing a career in the design and development of Internet of Things products, or those involved in entrepreneurial, innovative, or DIY communities, this course offers both theoretical knowledge and hands-on development practice. Key learning outcomes include understanding the DragonBoard™ 410c peripherals, navigating a Linux terminal, configuring an integrated development environment (IDE) for software development, utilizing Git and GitHub for version control, and creating projects that interface with sensors and actuators through GPIO and Arduino.

Sub-Topics
Advanced Projects and Code
Changing your Operating System (Supplemental / Optional)
DragonBoard Bringup and Ecosystem
Mezzanines and Sensors (Canned Demos w/ software)
Rescuing your Bricked Board (Supplemental / Optional)

Formative Assessments:

5 quizzes and 1 peer-review assignment.

Module 3: Internet of Things V2: Setting up and Using Cloud Services [10 Hours]

This course provides an introduction to Amazon Web Services (AWS) and its significance, enabling learners to make informed design decisions about which services to use. The course covers interfacing with the AWS cloud, developing software for data sending and receiving, and how to structure projects with diverse services. Upon completion, learners will have a clear understanding of the cloud, be able to install and configure the AWS CLI and SDK on a Linux system, utilize various AWS services such as EC2, IoT, etc., build projects heavily leveraging the cloud, and integrate the cloud into embedded systems.

Sub-Topics
Advanced Projects and Code - Deep dive
Systems Architecture

Cloud 101 for Dragonboard 410c
Real projects using AWS Cloud services

Formative Assessments:

3 quizzes and 1 peer-review assignment.

ASSESSMENT:

For summative assessments, Coursera will provide question banks for which exams can be conducted on the Coursera platform or the faculty will create their own assessments.

Note: If a Course or Specialization becomes unavailable prior to the end of the Term, Coursera may replace such Course or Specialization with a reasonable alternative Course or Specialization.

PCAC2011 CLOUD INFRASTRUCTURE & APPLICATIONS (3-0-0)

OVERALL COURSE OBJECTIVES: Students will synthesize and apply comprehensive knowledge on distributed and cloud computing concepts, cloud services, infrastructure, data analytics, storage services, machine learning, and real-time streaming technologies, leveraging major service providers to build, manage, and optimize scalable, effective cloud solutions using cutting-edge tools & techniques.

LEARNING OUTCOMES: On successful completion of the course the students shall be able to:

Understand and apply key distributed computing concepts for cloud computing including clouds, MapReduce, and NoSQL stores.

Utilize modern cloud technologies and the architecture behind the Cloud Systems and Infrastructure, and how virtualization and containers play a role.

Grasp how cloud service providers like Amazon, Google, and Microsoft organize their services and offerings.

Apply knowledge of cloud middleware technologies such as RPC and REST, JSON and load balancing for cloud-based applications.

Comprehend the operational aspects of cloud storage services such as Hive, HDFS, Ceph, cloud object storage systems, and more.

Implement data analytics applications on cloud, understand large scale data storage, consensus algorithms, real-time streaming technologies, and machine learning in cloud computing.

COURSE CONTENT:

Module 1: Cloud Computing Concepts: Part 2 [20 Hours]

Cloud computing systems today, whether open-source or used inside companies, are built using a common set of core techniques, algorithms, and design philosophies – all centered around distributed systems. Learn about such fundamental distributed computing "concepts" for cloud computing. Some of these concepts include: clouds, MapReduce, key-value/NoSQL stores, classical distributed algorithms, widely-used distributed algorithms, scalability, trending areas, and much, much more! Know how these systems work from the inside out. Get your hands dirty using these concepts with provided homework exercises. In the programming assignments, implement some of these concepts in template code (programs) provided in the C++ programming language. Prior experience with C++ is required. The course also features interviews with leading researchers and managers, from both industry and academia. This course builds on the material covered in the Cloud Computing Concepts, Part 1 course.

Sub-Topics

Classical Distributed Algorithms Continued
Concurrency and Replication Control
Emerging Paradigms
Classical Systems
Real-Life Behaviors

Formative Assessments:
6 quizzes and 1 coding/lab assignment.

Module 2: Cloud Computing Applications, Part 1: Cloud Systems and Infrastructure [15 Hours]

Welcome to the Cloud Computing Applications course - an ensemble of informative components providing detailed insights on the world of Cloud Computing and Big Data. The course begins with an introduction to cloud computing, its economic foundations, and the concept of big data. It progresses to software-defined architectures, cloud virtualization, and cloud provider offerings. Further focus is given on virtualization and container technologies including Docker, JVM, and Kubernetes. The course also deep dives into cloud offerings like platform-as-a-service, mobile backend-as-a-service, and serverless architectures with a focus on cloud middleware technologies. The topic of Metal-as-a-Service (MaaS) is also covered. The final week focuses on higher-level cloud

services, especially cloud storage services, with introductions to Hive, HDFS, and Ceph, cloud object storage systems, virtual hard drives, and archival storage options. The course wraps up with a discussion on Dropbox's cloud solution.

Sub-Topics
Introduction to Cloud Computing
Cloudonomics
Foundations: Containers, Virtual Machine, JVM
MAAS, PAAS, Web Services
Storage: Ceph, SWIFT, HDFS, NAAS, SAN, Zookeeper

Formative Assessments:
4 quizzes.

Module 3: Cloud Computing Applications, Part 2: Big Data and Applications in the Cloud [20 Hours]

The Cloud Computing Applications course provides comprehensive knowledge on Cloud Computing and Big Data. Starting with an overview of cloud computing, its economic underpinnings, and the concept of big data, the course then delves into software-defined architectures, cloud virtualization, and offerings from cloud service providers. Emphasizing virtualization and containers, it includes lectures on Docker, JVM, and Kubernetes. The course explores higher-level cloud offerings like platform-as-a-service, mobile backend-as-a-service, and serverless architectures, along with cloud middleware technologies. The module on Metal-as-a-Service (MaaS) is also included. The final week concentrates on high-level cloud services - particularly cloud storage services introducing Hive, HDFS, Ceph, cloud object storage systems, virtual hard drives, and archival storage options, concluding with a discussion on Dropbox's cloud solution.

Sub-Topics
Spark, Hortonworks, HDFS, CAP
Introduction to Distros
Large Scale Data Storage
Streaming Systems
Big Data Machine Learning Introduction
Graph Processing and Machine Learning

Formative Assessments:
4 quizzes.

ASSESSMENT:

For summative assessments, Coursera will provide question banks for which exams can be conducted on the Coursera platform or the faculty will create their own assessments.

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PCAC2010 APPLICATION DEVELOPMENT - TOOLS & TECHNOLOGIES (3-0-0)

OVERALL COURSE OBJECTIVES: To develop comprehensive knowledge and skills in Python, AI application development, and interacting with databases, which enables the learner to apply Python to data science tasks, develop AI-driven applications, manage SQL databases, and implement full-stack Django-based solutions.

LEARNING OUTCOMES: On successful completion of the course the students shall be able to:

Understand and implement basic and advanced Python concepts, including the use of libraries like Pandas, Numpy & Beautiful Soup.

Develop the ability for data collection, manipulation, and web scraping using Python.

Apply foundational Python skills to develop Artificial Intelligence (AI) enabled applications with Python and Flask.

Employ different Python techniques to develop web applications, write unit tests, and package applications for distribution.

Gain a thorough understanding of SQL and how Python interacts with databases using Object-Relational Mapping (ORM) with Django.

Implement a Django web application to manage data and gain experience deploying it to the cloud.

COURSE CONTENT:

Module 1: Python for Data Science, AI & Development [27 Hours]

This beginner-friendly, self-paced Python course starts from basics and progresses to programming in Python within a few hours. None prior programming experience needed! The course covers Python basics, different data types, and core components such as List, Tuples, conditions, and branching. It also illustrates how to utilize Python libraries like Pandas, Numpy, and Beautiful Soup, and perform data collection and web scraping tasks using APIs. The learning experience is enriched with hands-on labs using Jupyter Notebooks. On course completion, learners should be able to create basic programs, work with data, and automate real-world tasks using Python. It is an ideal choice for aspiring data scientists, software developers, data engineers, and individuals interested in AI and DevOps roles.

Sub-Topic
APIs, and Data Collection
Python Basics
Python Data Structures
Python Programming Fundamentals
Working with Data in Python

Formative Assessments:
6 graded quizzes.

Module 2: Developing AI Applications with Python and Flask [19 Hours]

This mini course provides hands-on experience in applying basic Python skills to develop Artificial Intelligence (AI) enabled applications. As a developer, learners will undertake various tasks such as developing functions and application logic, exchanging data through Watson AI libraries, writing unit tests, and packaging applications for distribution. The course allows learners to demonstrate their foundational Python skills through the development of web applications and AI-powered solutions. On completion, not only will learners gain confidence in creating AI-enabled applications with Python, Flask, Watson AI libraries, and handling unit tests, but will also add a valuable project to their portfolio.

Sub-Topics
Creating AI Application and Deploy using Flask
Python Coding Practices and Packaging Concepts

Web App Deployment using Flask

Formative Assessments:
1 peer-review assignment and 2 staff graded assignments.

Module 3: Django Application Development with SQL and Databases [14 Hours]

This course, crucial for developers, particularly in Back-End, Full Stack, and DevOps roles, focuses on the fundamentals of relational databases and how to access them from applications. Recognizing that key tasks in application development involve accessing, processing, and presenting data, the course provides insights into foundational database concepts and the basics of SQL. Besides SQL, learners will explore Object-Relational Mapping (ORM), which facilitates the use of Object-Oriented Programming languages, like Python, with databases. The course also assists in acquiring full-stack Django skills through the creation of a Django web app and offers hands-on experience in cloud deployment. Hands-on labs and a final project ensure learners can apply their knowledge and add a valuable asset to their portfolio.

Sub-Topics
Getting Started with SQL & Relational Databases
Consolidate and Deploy Your Django App
Full-stack Django Development
ORM: Bridging the Gap Between the Real World and Relational Model

Formative Assessments:
3 graded quizzes, 1 peer-review assignment and 2 staff graded assignments.

ASSESSMENT:

For summative assessments, Coursera will provide question banks for which exams can be conducted on the Coursera platform or the faculty will create their own assessments.

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PCAC2009 BIG DATA INTEGRATION AND MANAGEMENT (3-0-0)

OVERALL COURSE OBJECTIVES: The overall course objective is to enable learners to effectively understand and handle big data issues, develop skillsets for processing and integrating big data on Hadoop and Spark platforms, and apply machine learning techniques to construct data-driven models and facilitate decision-making process.

LEARNING OUTCOMES: On successful completion of the course the students shall be able to:

Ability to recognize different data elements in various scenarios and explain the necessity for a Big Data Infrastructure Plan and Information System Design.

Ability to select suitable data models for specific types of data and apply techniques for handling streaming data.

Proficiency in retrieving data from different databases and big data management systems, and identifying when a big data problem needs data integration.

Capability to execute basic big data integration and processing on Hadoop and Spark platforms.

Ability to design a strategy to leverage data using the steps in the machine learning process and apply machine learning techniques to explore and prepare data for modelling.

Proficiency in constructing models that learn from data using open source tools and analyzing big data problems using scalable machine learning algorithms on Spark.

COURSE CONTENT:

Module 1: Big Data Modeling and Management Systems [13 Hours]

This course covers how to collect, store, and organize big data using appropriate management tools. It explores a range of data genres, big data platforms, big data management systems, and analytical tools. Guided, hands-on tutorials provide familiarization with techniques using real-time and semi-structured data examples. Systems and tools covered include AsterixDB, HP Vertica, Impala, Neo4j, Redis, SparkSQL. Key learning outcomes include identifying different data elements, designing a Big Data Infrastructure Plan and Information System, handling streaming data, differentiating between a traditional Database Management System and a Big Data Management System, and designing a big data information system. The course is suitable for those new to data science with completion of the Intro to Big Data recommended. Basic installation skills and virtual machine usage are necessary for hands-on assignments.

Sub-Topic
Designing a Big Data Management System for an Online Game
Introduction to Big Data Modeling and Management
Working With Data Models
Exploring Streaming Sensor Data
DBMS-based and non-DBMS-based Approaches to Big Data

Formative Assessments:
4 graded quizzes and 1 Peer-review assignment.

Module 2: Big Data Integration and Processing [18 Hours]

The course covers the process of identifying, collecting, storing, and organizing big data. It explores various data genres, management tools, big data platforms, management systems, and analytical tools. Through hands-on tutorials, learners will get familiar with real-time and semi-structured data examples. The course discusses various systems and tools including AsterixDB, HP Vertica, Impala, Neo4j, Redis, and SparkSQL. By the end, learners will be able to recognize different data elements, understand why a Big Data Infrastructure Plan is necessary, identify frequent data operations, select suitable data models, handle streaming data, differentiate between traditional and big data management systems, and design a big data information system. It is intended for data

science beginners. Prior programming experience is not needed, but the ability to install applications and utilize a virtual machine is essential for hands-on assignments.

Sub-Topic
Big Data Analytics using Spark
Big Data Integration
Learn By Doing: Putting MongoDB and Spark to Work
Processing Big Data
Retrieving Big Data

Formative Assessments:
10 graded quizzes

Module 2: [Machine Learning With Big Data] [22 Hours]

This course provides an introduction to machine learning techniques used to explore, analyze, and utilize data. It offers insights into various tools and algorithms for creating machine learning models that can learn from data and handle big data problems. After completion, learners will be equipped to devise an approach to leverage data using machine learning processes, apply machine learning techniques for data modeling, recognize the type of machine learning problem to implement suitable techniques, create models with widely available open-source tools, and analyze big data problems using scalable machine learning algorithms on Spark.

Sub-Topic
Data Exploration
Data Preparation
Evaluation of Machine Learning Models
Introduction to Machine Learning with Big Data
Regression, Cluster Analysis, and Association Analysis

Formative Assessments:
11 graded quizzes.

ASSESSMENT:

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PCAC2008 MACHINE LEARNING TECHNIQUES AND APPLICATIONS 3-0-0

OVERALL COURSE OBJECTIVES: Acquire and apply knowledge of machine learning models to solve complex problems across various fields, manage machine learning projects effectively using data science processes, and make informed decisions on technology choices in machine learning system designs.

LEARNING OUTCOMES: On successful completion of the course the students shall be able to:

Gain foundational knowledge of various machine learning models such as logistic regression, multilayer perceptrons, and convolutional neural networks.

Apply machine learning models to address complex problems in different fields such as medical diagnostics, image recognition, and text prediction.

Perform hands-on tasks using PyTorch and other open-source libraries to implement machine-learning algorithms.

Identify potential opportunities for implementing machine learning to resolve user problems.

Use the data science process to effectively manage and organize machine learning projects.

Evaluate and decide on key technology choices in machine learning system design.

COURSE CONTENT:

Module 1: Introduction to Machine Learning [25 Hours]

This course will provide you a foundational understanding of machine learning models (logistic regression, multilayer perceptrons, convolutional neural networks, natural language processing, etc.) as well as demonstrate how these models can solve complex problems in a variety of industries, from medical diagnostics to image recognition to text prediction. In addition, we have designed practice exercises that will give you hands-on experience implementing these data science models on data sets. These practice exercises will teach you how to implement machine learning algorithms with PyTorch, open source libraries used by leading tech companies in the machine learning field (e.g., Google, NVIDIA, CocaCola, eBay, Snapchat, Uber and many more).

Sub-Topic
Simple Introduction to Machine Learning
Basics of Model Learning
Image Analysis with Convolutional Neural Networks
Recurrent Neural Networks for Natural Language Processing
The Transformer Network for Natural Language Processing
Introduction to Reinforcement Learning

Formative Assessments:
4 quizzes and 11 ungraded lab assignments.

Module 2: Managing Machine Learning Projects [18 Hours]
This practical course, part of the AI Product Management Specialization by Duke University's Pratt School of Engineering, provides detailed insights into managing machine learning projects. Walking through each stage of an ML project - right from identifying valid opportunities for ML, to data collection, model building, deployment, and maintenance of production systems - it imparts knowledge of the data science process and its ML applications, and the vital decisions made in ML system design. By the end of the course, participants will be adept at recognising ML application opportunities, applying the data science process to organize ML projects, evaluating crucial technology decisions in ML system design, and leading ML projects from ideation through to production.

Sub-Topic
Identifying Opportunities for Machine Learning
Organizing ML Projects
Data Considerations
ML System Design & Technology Selection
Model Lifecycle Management

Formative Assessments:
5 quizzes and 1 peer-review assignment.

ASSESSMENT:

For summative assessments, Coursera will provide question banks for which exams can be conducted on the Coursera platform or the faculty will create their own assessments.

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MEPC2208 DESIGN OF MACHINE ELEMENTS-I LAB. (0-0-3)

1. Design of riveted joint
2. Design of welded joint.
3. Design of cotter joint.
4. Design of knuckle joint.
5. Design of shaft.
6. Design of flexible coupling.
7. Design of rigid coupling.
8. Design of helical spring.
9. Design of journal bearing.
10. Design of elements of roller bearing.

MEPC2207 MACHINES AND MECHANISMS LAB. (0-0-3)

1. Design of any one working model related to Kinematics & Dynamics of Machines, Module I &II.
2. Design of any one working model related to Kinematics & Dynamics of Machines, Module III,IV& V.
3. Experiments on Simple/Compound/Reverted Gear trains.
4. Study of interference and undercutting for gear drives.
5. Determination of Moment of Inertia of a fly wheel.
6. Performance characteristics of a spring loaded governor.
7. Experiment/Study on Screw Jack.
8. Experiment/Study on clutches.
9. Experiment on static and dynamic balancing apparatus.

MEPC2206 FLUID MECHANICS
AND FLUID MACHINERY LABORATORY (0-0-3)

OBJECTIVE

To study the flow measurement and the performance of fluid machinery

LIST OF EXPERIMENTS

1. Calibration of venturimeter
2. Pressure measurement with pitot static tube
3. Determination of pipe flow losses.
4. Verification of Bernoulli's theorem
5. Flow visualization by Heleshaw apparatus
6. Performance test on centrifugal pumps
7. Performance test on reciprocating pumps
8. Determination of Viscosity of a Fluid

MEPC2205 BASIC MANUFACTURING PROCESSES LAB. (0-0-3)

List of Experiments:

1. Determination of grain size.
2. Determination of clay content, and permeability.
3. Preparation of pattern and foundry practices.
4. Practice and preparation of jobs through arc welding.
5. Practice and preparation of jobs through oxyacetylene welding.
6. Determination of strength of brazed and solder joints
7. Practice and preparation of jobs using sheet metal forming processes like forming and deep drawing.
8. Demonstration of different rolling mills.
9. Demonstration of Extrusion processes.

MEPC2006 BASIC MANUFACTURING PROCESSES (3-0-0)

Course Objectives

1. To introduce students to fundamental manufacturing processes, including primary and secondary processes, and their importance in engineering applications.
2. To familiarize students with the principles and practices of metal casting, including the design of gating systems, properties of moulding materials, and defect analysis.
3. To provide an understanding of various welding techniques, including gas welding, arc welding, resistance welding, and solid-state welding, along with their applications and testing methods.
4. To explain the concepts of metal forming processes such as rolling, forging, extrusion, and sheet metal working, focusing on their principles, techniques, and defect analysis.
5. To give students an overview of advanced manufacturing techniques such as explosive forming and coating methods, and their applications in industry.

Module-I (10hrs)

Manufacturing concepts: Primary and secondary manufacturing processes, Principle of metal casting: Terminology, Types of patterns, pattern materials and pattern allowances. Moulding Materials, sand casting, continuous casting, centrifugal casting, die casting, investment casting, shell moulding. Composition of moulding sand, binders, additives. Properties of moulding sand and sand testing. Casting defects. Melting furnaces - cupola, resistance furnace, induction and arc furnace, Solidification of castings, design of sprue, gating system, runner, and riser.

Module-II (08hrs)

Weldability; Classification of welding processes, Introduction to gas welding, Oxyacetylene welding, Flame cutting. Principles and processes of arc welding (SMAW, GTAW, GMAW, FCAW, PAW, SAW). Brazing and soldering; Principle of resistance welding. Principle of friction welding, Solid state welding; Weld inspection and testing.

Module-III (06hrs)

Formability of metals; Cold and hot working; Rolling: types of rolling mills, Rolling defects. Forging: Smith Forging, Drop and Press forging, M/c forging, Forging defects. Extrusions: Direct, Indirect, Impact and Hydrostatic extrusion and their applications.

Module-IV (06hrs)

Brief introduction to sheet metal working: Bending, Forming, Deep drawing, Wire drawing shearing, Stretch forming, Metal spinning, Embossing and Coining. Brief introduction to explosive forming, coating and deposition methods.

Course Outcomes (CO) After completing this course, students will be able to:

1. Define the basic concepts and classifications of primary and secondary manufacturing processes.
2. Explain the principles of metal casting, welding, and forming processes, along with their underlying mechanisms and materials.
3. Apply knowledge of casting design to create appropriate sprue, gating systems, and risers for defect-free castings.
4. Analyze various manufacturing processes like welding and rolling to identify defects, determine process suitability, and recommend improvements.
5. Evaluate the properties of moulding sand, weldments, and formed metals to ensure quality and process efficiency.

Design innovative solutions for manufacturing challenges, integrating advanced techniques like coating methods and explosive forming for complex engineering applications.

Books:

1. Manufacturing technology by P.N.Rao, Tata McGraw Hill publication.
2. Welding Technology by R.A. Little, TMH

3. Manufacturing Engineering & Technology by Kalpak Jain, Addition Wesley Edition
4. Principles of Metal Casting by Hein and Rosenthol, Tata Mc-Graw Hill India.
5. A Text Book of Production Engineering by P.C.Sharma, S.Chand.

MEPC2005 DESIGN OF MACHINE ELEMENTS-I (3-0-0)

Module–I: (6hrs)
Mechanical Engineering design: Introduction to design procedure, Stages in design, Code and Standardization, Interchangeability, Preferred numbers, Fits and Tolerances, Factor of safety concept,Engineering materials: Ferrous, Non-ferrous, design requirements – Properties of Materials, Material selection, Use of Data books.

Module–II: (6 hrs)
Machine Element Design: Design of Joints: Rivets, Welds and threaded fasteners based on different types of loading, Boiler joints, cotter joints and knuckle joints.

Module–III: (6hrs)
Design of Keys, Shaft and Couplings: Classification of keys and pins, Design of keys and pins, Design of shafts: based on strength, torsional rigidity and fluctuating load, ASME code for shaft design, Design of couplings: Rigid coupling, Flexible coupling.

Module–IV: (6hrs)
Design of Mechanical Springs: Types of helical springs, Design of Helical springs, bulking of spring, spring surge, end condition of springs, Design of leaf springs: nipping.

Module–V: (6hrs)
Bearings: Types and selection of ball and roller bearings, Dynamic and static load ratings, Bearing life, Design of sliding contact bearings, Journal bearing, foot step bearing.

TEXTBOOKS:

1. Mechanical Engineering Design, J.E.Shigley, C.R.Mischke, R.G.Budynas and K.J.Nisbett, TMH.
2. Design of Machine Elements, V.B.Bhandari, Tata McGraw Hill

REFERENCEBOOKS:

1. Machine Design, P.Kanaiah,Scietech Publications
2. Fundamentals of Machine Component Design by R.C.Juvinall and K.M.Marshek, JohnWiley & Sons
3. Machine Design, P.C.Sharmaand D.K.Agrawal, S.K.Kataria&Sons
4. Machine Design, Pandyaand Shah, Charotar Book Stall
5. Machine Design, Robert L.Norton, Pearson Education Asia.

DESIGN DATA HANDBOOKS:

1. Design Hand Book by S.M.Jalaluddin; Anuradha Agencies Publications
2. P.S.G.Design Data Hand Book,PSG College of Tech Coimbature
3. Design Data HandBook, K.Lingaiah, McGrawHill, 2ndEd. 2003.
4. Design Data Hand Book by K.Mahadevanand B.Reddy, CBS Publishers

MEPC2004 KINEMATICS & DYNAMICS OF MACHINES (3-0-0)

Module I (6hrs)
Kinematic Fundamental: Mechanisms: Basic kinematic concepts & definitions, mechanisms, link, kinematic pair, degrees of freedom, Kinematic chain, degrees of freedom for plane mechanism, Gruebler's equation, Inversion of mechanism, Four bar chain & their inversions, Single slider crank chain, Double slider crank chain & their inversion.
Kinematic Analysis: Graphical analysis of position, Velocity and acceleration of four barand Slider crank mechanisms. Instantaneous centre method, Aronhold-Kennedy Theorem, Rubbing velocity at a Pin-joint.Coriolis component of acceleration.

Module II (6 hrs)
Gear and Gear Trains: Gear terminology, Types of Gear, Tooth properties and methods of generation of standard tooth profiles, Force analysis. Types of gear trains: Simple, Compound, Reverted and Epicyclic gear trains, Train value, Methods of finding train value/velocity ratio: Tabular method and analytical method for Epicyclic gear trains.

Module III (6hrs)
Turning Moment Diagram and Flywheel: Turning moment diagram, Turning moment diagrams for different types of engines, Fluctuation of energy and fluctuation of speed,Theory of Flywheel.
Mechanism for Control (Governors): Governors-Watt, Porter, Proell, Hartnell. Performance parameters: Sensitiveness, Stability, Hunting, Isochronism.Governor Effort and Power.

Module IV (6hrs)
Friction Effects: Screwjack, Friction between pivot and collars, Single, Multi-plate and cone clutches, anti-friction bearing.
Flexible Mechanical Elements: Belt, Rope and chain drives, Initial tension, Effect of centrifugal tension on power transmission, Maximum power transmission capacity, Beltcreepandslip.
Brakes: Classification of brakes, Types of brakes, Analysis of different brakes, Braking of a vehicle.

Module V (6hrs)
Balancing of rotating components and linkages: Static and Dynamic Balancing, Balancing of Single Rotating Mass by Balancing Masses in Same plane and in Different planes. Balancing of Several Rotating Masses rotating in same plane and in Different planes.

TEXT BOOKS:
1. Theory of Machines by S.S.Rattan, Tata MacGraw Hill
2. Theory of Machines by Thomas Bevan, CBS Publications
3. Kinematics and Dynamics of Machinery by Charles E. Wilson and J.Peter Saddler, Pearson Education.

REFERENCE BOOKS:
1. Theory of Machines and Mechanisms: By Joseph Edward Shigley
2. Mechanism & Machine Theory by J. S. Rao and R. V. Dukipatti, New Age International.
3. Theory of Mechanisms and Machines by A. Ghosh & A. K. Mallick, East West Press.
4. Kinematics and Dynamics of Machines by G.H. Martin, Mc Graw-Hill.
5. Theory of Machines and Mechanisms by P.L.Ballaney, Khanna Publishers .

MEPC2003 FLUID MECHANICS AND HYDRAULIC MACHINES (3-0-0)

Module I (06hrs)
Introduction: Scope of fluid mechanics; Properties of fluids (density, specific gravity, specific weight, specific volume, surface tension and capillarity, viscosity, compressibility and bulk modulus); Fluid classification
Fluid Statics: Pressure, Pascal's law, Pressure variation for incompressible fluid,Atmospheric pressure, Absolute pressure. Gauge pressure and vacuum pressure, Manometers, Hydrostatic forces on submerged surfaces, Force on a horizontal submerged plane surface, force on a vertical submerged plane surface, Buoyancy and flotation, Archimedes' principle, Stability of immersed and floating bodies, Determination of metacentric height.

Module II (06hrs)
Fluid Kinematics: Introduction, Description of fluid flow, Classification of fluid flow, Reynolds number, Acceleration of fluid flow, Flow rate, Continuity equation, Differential equation of continuity, Mathematical description of irrotational and rotational flow, Circulation, Potential function and stream function, Flow net.

Module III (06hrs)
Fluid Dynamics: Introduction to Navier Stokes equation, Non-dimensional numbers, Euler's equation along a streamline, Energy equation, Bernoulli's equation and its application to venturimeter, Orificemeter, Pitot tube and siphon, Flow in pipes and ducts, Hydraulic gradient lines (HGL), Total energy line (TEL), Power transmission in fluid flow through pipes, Fluid flow in pipes in series and parallel.

Module IV (06hrs)
Impact of Jets: Flat, inclined and curved plates with stationary and moving cases.
Hydraulic Turbines: Classifications, Impulse and Rection turbines, Efficiency and performance curves.
Reaction Turbines: Francis turbine and Kaplan turbine, velocity triangle and efficiencies, performance curve, Function of draft tube and casing cavitation.

Module V (06hrs)
Centrifugal Pump: Constructional features, Vane shapes, Velocity triangles, efficiencies, Multistaging, Pump characteristics, NPSH and Cavitation.
Positive Displacement Pumps: Reciprocating pumps, Working principles, Discharge, Work done and Power requirement, Slip, Indicator diagram.

Books:

- Fluid Mechanics, Y.A.Cengel,Publisher: TMH.
- Fluid Mechanics and Hydraulic Machines, Modi and Sheth.
- Introduction to Fluid Mechanics and Fluid Machines, S.K.Som and G. Biswas, TMH.
- Fluid Mechanics and Fluid Machines, A. K. Jain, Khanna Publications.
- Introduction to Fluid Mechanics, Fox, McDonald, Willey Publications.
- An Introduction to Fluid Dynamics, G.K. Batchelor, Cambridge University Press.
- Fluid Mechanics, J.F. Douglas, J.M. Gasiorek, J.A. Swaffield and L.B. Jack, Pearson Education.

HSHS2002 ORGANISATIONAL BEHAVIOUR (3-0-0)

Objectives:

The objective is to develop an understanding of the behavior of individuals and groups inside organizations and to enhance skills in understanding and appreciating individuals, interpersonal, and group process for increased effectiveness both within and outside of organizations. Further, it is to develop theoretical and practical insights and problem-solving capabilities for effectively managing the organizational processes.

Module-I: (06 Hrs.)

Fundamentals of OB: Definition, scope and importance of OB, Relationship between OB and the individual, Evolution of OB, Theoretical framework (cognitive), behavioristic and social cognitive), Limitations of OB.

Module-II: (12 Hrs.)

Attitude: Importance of attitude in an organization, Right Attitude, Components of attitude, Relationship between behavior and attitude, Developing Emotional intelligence at the workplace, Job attitude, Barriers to changing attitudes.

Personality and values: Definition and importance of Personality for performance, The Myers-Briggs Type Indicator and The Big Five personality model, Significant personality traits suitable to the workplace (personality and job — fit theory), Personality Tests and their practical applications.

Perception: Meaning and concept of perception, Factors influencing perception, Selective perception, Attribution theory, Perceptual process, Social perception (stereotyping and halo effect). Motivation: Definition & Concept of Motive & Motivation, The Content Theories of Motivation (Maslow's Need Hierarchy & Herzberg's Two Factor model Theory), The Process Theories (Vroom's expectancy Theory & Porter Lawler model), Contemporary Theories — Equity Theory of Work Motivation.

Module-III: (10 Hrs.)

Foundations of Group Behavior: The Meaning of Group & Group behavior & Group Dynamics, Types of Groups, The Five — Stage Model of Group Development.

Managing Teams: Why Work Teams, Work Teams in Organization, Developing Work Teams, Team Effectiveness & Team Building.

Leadership: Concept of Leadership, Styles of Leadership, Trait Approach Contingency Leadership Approach, Contemporary leadership, Meaning and significance of contemporary leadership, Concept of transformations leadership, Contemporary theories of leadership, Success stories of today's Global and Indian leaders.

Module-IV: (08 Hrs.)

Organizational Culture : Meaning & Definition of Organizational Culture, creating & Sustaining Organizational Culture, Types of Culture (Strong vs. Weak Culture, Soft Vs. Hard

Culture & Formal vs. Informal Culture), Creating Positive Organizational Culture, Concept of Workplace Spirituality.

Module-V: (09 Hrs.)

Organizational Change: Meaning, Definition & Nature of Organizational Change, Types of Organizational Change, Forces that acts as stimulants to change.

Implementing Organizational Change : How to overcome theResistance to Change,

Approaches to managing Organizational Change, Kurt Lewin's-Three step model, Seven Stage model of Change & Kotter's Eight-Step plan for Implementing Change, Leading the Change Process, Facilitating Change, Dealing with Individual & Group Resistance, Intervention Strategies for Facilitating Organizational Change, Methods of Implementing Organizational Change, Developing a Learning Organization.

Course Outcomes:

At the end of the course, students will be able to:

1. Understand the basic concepts of OB, change management, organizational culture and their implementation in organizations.
2. Identify and examine team characteristics for improved organizational performance.
3. Apply theories and frameworks to solve problems and take effective decisions for organizational success.
4. Analyze group behavior and leadership styles for effective people management.
5. Evaluate individual personality types and group behaviours for improving organizational processes and practices.
6. Develop leadership competency to manage organizational situations.

Books:

1. Understanding Organizational Behaviour, Parek, Oxford
2. Organizational Behaviour, Robbins, Judge, Sanghi, Pearson.
3. Organizational Behaviour, K. Awathappa,HPH.
4. Organizational Behaviour, VSP Rao, Excel
5. Introduction to Organizational Behaviour, Moorhead, Griffin, Cengage.
6. Organizational Behaviour, Hitt, Miller, Colella, Wiley.

HSHS2001 ENGINEERING ECONOMICS (3-0-0)

Objectives:

To provide basic concept of micro and macro economics, engineering economics and their application in engineering economy. Further, to develop the ability to account for time value of money using engineering economy factors and formulas.

Module - I (05 hours)

Engineering Economics- Nature, Scope, Basic problems of an economy, Micro Economics and Macro Economics.

Demand - Meaning of demand, Demand function, Law of Demand and its exceptions, Determinants of demand, Elasticity of demand & its measurement (Simple numerical problems to be solved), Demand Forecasting Meaning

Supply-Meaning of supply, Law of supply and its exception, Determinants of supply, Elasticity of supply, Determination of market equilibrium (Simple numerical problems to be solved).

Module - II (O8 hours)

Production - Production function, Laws of returns: Law of variable proportion, Law of returns to scale

Cost and Revenue Concepts - Total Costs, Fixed cost, Variable cost, Total revenue, Average revenue and Marginal revenue, Cost-Output Relationships in the Short Run, and Cost-Output Relationships in theLong Run, Analysis of cost minimization.

Module III (08 hours)

Market - Basic understanding of different market structures, Determination of equilibrium price under perfect competition (Simple numerical problems to be solved), Break Even Analysis-linear approach (Simple numerical problems to be solved).

Module - IV (12 hours)

Time Value of Money- Interest - Simple and compound, nominal and effective rate of interest, Cash flow diagrams, Principles of economic equivalence.

Evaluation of Engineering Projects -Present worth method, Future worth method, Annual worth method, Internal rate of return method, Cost benefit analysis for publicprojects.

Depreciation- Depreciation of capital assert, Causes of depreciation, Methods of calculating depreciation - Straight line method, Declining balance method, SOYD method, After tax comparison of project

Module V (06 Hours)

Inflation-Meaning of inflation, types, causes, measures to control inflation.

National Income-Definition, Concepts of national income, Method of measuring national income.

Banking -Commercial bank. Functions of commercial bank, Central bank, Functions of Central Bank.

Books:

Principles of Economics by Deviga Vengedasalam and Karaunagaran Madhavan, Oxford

Riggs, Bedworth and Randhwa, "Engineering Economics", McGraw Hill Education India

C. S. Park, Contemporary Engineering Economics, 6th Edition, Pearson Education, 2015.

Engineering Economy by William G.Sullivan, Elin M.Wicks, C. Patric Koelling, Pearson

R.Paneer Seelvan, " Engineering Economics", PHI

Ahuja,H.L., "Principles of Micro Economics" , S.Chand & Company Ltd

Jhingan,M.L., "Macro Economic Theory"

Macro Economics by S.P.Gupta, TMH

Course Outcomes of Engineering Economics

At the end of the course the students will be able to

CO1 Remembering : Define the basic concept of micro and macro economics, engineering economics and their application in engineering economy.

CO2 Understanding : Evaluate numerically the effects of changes in demand and supply on price determination of products and services.

CO3 Analyze : the macroeconomic environment and financial systems of the country and its impact on business, society and enterprise.

CO4 Develop : the ability to account for time value of money using engineering economy factors and formulas.

CO5 Apply: knowledge of mathematics, economics and engineering principles to solve engineering problems and to analyze decision alternatives in engineering projects considering upon depreciation, taxes and inflation.

BACHELOR OF TECHNOLOGY

MECHANICAL ENGINEERING

THIRD YEAR (FIFTH SEMESTER)

W.E.F. ADMISSION BATCH 2023-24

Sl. No.	Category	Course Code	Course	Contact Hrs. L-T-P	Credit	University Marks	Internal Evaluation
Subject (Theory)							
1	PC	MEPC3001	Design of Machine Elements – II	3–0–0	3	100	50
2	PC	MEPC3002	Heat Transfer	3–0–0	3	100	50
3	PC	MEPC3003	Metal Cutting & Machining	3–0–0	3	100	50
4	PE	MEPE3001	Optimization Method In Engineering Design	3–0–0	3	100	50
		MEPE3002	Metrology, Quality Control and Reliability				
		MEPE3003	Production and Operation Management				
		MEPE3004	Refrigeration & Air Conditioning				
		MEPE3005	Advanced Mechanics of Solids				
		–	–				
		–	–				
5	HS	HSHS3001	Business Management	3–0–0	2	100	50
		HSHS3002	Entrepreneurship Development				
6	MC	MCMC3001	Environmental Engineering	3–0–0	2	100	50
		MCMC3002	Industrial Safety Engineering				
Subject (Sessional / Practical)							
7	PC	MEPC3201	Design of Machine Elements – II Laboratory	0–0–3	1.5	–	100
8	PC	MEPC3202	Machining Laboratory	0–0–3	1.5	–	100
9	PC	MEPC3203	Soft Computing Laboratory	0–0–3	1.5	–	100
10	PSI	MEPS3201	Seminar on SIRE – I	0–0–3	1.5	–	100
			Total	**18-0-12**	**22**	**600**	**700**

Click here to view/download the syllabus of the subjects.

HSHS3001 BUSINESS MANAGEMENT (3-0-0)

Course Objectives

By the end of this course, students will be able to:

- Understand fundamental management principles
- Learn project management techniques and its application
- Understand the financial aspects of engineering decisions
- Demonstrate leadership, communication, and team management skills
- Understand the basics of entrepreneurship and innovation management

Module-I: Management Foundations and Organizational Dynamics

Introduction to Management: Functions of Management; Evolution of management thought and its relevance to engineering; Management vs. Leadership: Key distinctions; Decision-making processes; Organizational design and structure; Team dynamics and group behaviour; Motivation theories and their application to technical teams; Organizational Communication; Cultural considerations in global business environment

Module-II: Project Management and Financial Decision Making

Project lifecycle and phases; Work breakdown structure and scheduling; Resource allocation and budgeting; Risk management in engineering projects; Quality management and control; Basic financial statements and their interpretation; Time value of money; Budgeting and cost control; Return on investment (ROI) and net present value (NPV); Funding sources for engineering projects; Cost-benefit analysis for technical decisions

Module-III: Leadership, Innovation and Entrepreneurship

Leadership styles and their effectiveness; Managing technical teams and professionals; Performance management and feedback; Recruitment and selection in engineering roles; Training and development of technical staff; Ethical leadership in engineering; Innovation management; Technology transfer and commercialization; Startup fundamentals; Intellectual property basics; Business model development

Course Outcomes

CO1: Recall fundamental management principles, organizational theories, and project management methodologies, key financial concepts used in engineering decision-making.

CO2: Explain the relationship between management functions (planning, organizing, leading, controlling) and their application.

CO3: Demonstrate project management skills and apply financial analysis techniques for decision making.

CO4: Analyse organizational behaviour patterns, team dynamics, and performance issues in engineering management contexts.

CO5: Judge ethical implications of management decisions and leadership actions in professional engineering practice.

CO6: Create integrated management solutions for solving complex business problems.

Reference Books:

1. Management Theory and Practice" by C.B. Gupta
2. Essentials of Management" by Koontz, Weihrich, and Aryasri (Indian Edition)
3. Project Management for Engineering and Technology" by N.K. Sharma
4. Financial Management: Theory and Practice" by Prasanna Chandra
5. Organizational Behaviour" by Aswathappa K.
6. Human Resource Management" by V.S.P. Rao
7. Entrepreneurship Development" by S.S. Khanka
8. Operations Management" by R. Panneerselvam

HSHS3002 ENTREPRENEURSHIP DEVELOPMENT (3-0-0)

Course Objectives –

1. To explain concept of entrepreneurship and build and understanding about business situation in which entrepreneurs act.
2. To explain classification and type of entrepreneurs and the process of entrepreneurial project development
3. To discuss the steps in venture development and new trends in entrepreneurship.
4. The more focus is given on creativity and innovation.

Module-I: (10 hours)

Entrepreneurship: Concept of entrepreneurship and intrapreneurship, Types of Entrepreneurs, Nature and Importance, Entrepreneurial Traits and Skills, Entrepreneurial Motivation and Achievement, Entrepreneurial Personality

Module-II: (08 hours)

Entrepreneurial Environment, Identification of Opportunities, Converting Business Opportunities into reality. Start-ups and business incubation, Setting up a Small Enterprise. Issues relating to location, Environmental Problems and Environmental pollution Act, Industrial Policies and Regulations

Module-III: (10 hours)

Need to know about Accounting, Working capital Management, Marketing Management, Human Resources Management, and Labour Laws. Organizational support services - Central and State Government, Incentives and Subsidies.

Module-IV: (12 hours)

Sickness of Small-Scale Industries, Causes and symptoms of sickness, cures of sickness, Role of Banks and Governments in reviving industries.

Course Outcomes

After completion of this course, students

CO1: will aware about foundation of entrepreneurship development and its theories
CO2: will identify the type of entrepreneur and the steps involved in a entrepreneurial venture.
CO3: will understand various steps involved in starting a venture and to explore marketing methods & new trends in entrepreneurship.
CO4: Think creative and innovative

Books:

1. Entrepreneurship Development and Management, Vasant Desai, HPH
2. Entrepreneurship Management, Bholanath Dutta, Excel Books
3. Entrepreneurial Development, Sangeeta Sharma, PHI
4. Entrepreneurship, Rajeev Roy, Oxford University Press

MCMC3001 ENVIRONMENTAL ENGINEERING (3-0-0)

Course Objectives:

- To acquire basic knowledge of source of water and various treatment processes
- To determine the sewage quantity, and understand its treatment and disposal
- To Identify and value the effect of the pollutants in atmosphere
- To formulate strategies to solid waste management

Module-I: (08 Hrs)

Water: Sources of Water and quality issues, water quality requirement for different beneficial uses, Water quality standards, water quality indices, water safety plans, Water Supply systems, Need for planned water supply schemes, Water demand industrial and agricultural water requirements, Components of water supply system; Transmission of water, Distribution system, Various valves used in W/S systems, service reservoirs and design. Water Treatment: aeration, sedimentation, coagulation flocculation, filtration, disinfection, advanced treatments like adsorption, ion exchange, membrane processes.

Module-II: (08 Hrs)

Sewage- Domestic and Storm water, Quantity of Sewage, Sewage flow variations. Conveyance of sewage- Sewers, shapes design parameters, operation and maintenance of sewers, Sewage pumping; Sewerage, Sewer appurtenances, Design of sewerage systems. Small bore systems, Storm Water- Quantification and design of Storm water; Sewage and Sullage, Pollution due to improper disposal of sewage, National River cleaning plans, Wastewater treatment, aerobic and anaerobic treatment systems, suspended and attached growth systems, recycling of sewage – quality requirements for various purposes.

Module-III: (08 Hrs)

Air - Composition and properties of air, Quantification of air pollutants, monitoring of air pollutants, Air pollution- Occupational hazards, Urban air pollution automobile pollution, Chemistry of combustion, Automobile engines, quality of fuel, operating conditions and interrelationship. Air quality standards, Control measures for Air pollution, construction and limitations

Module-IV: (08 Hrs)

Noise-Basic concept, measurement and various control methods. Solid waste Management-Municipal solid waste, Composition and various chemical and physical parameters of MSW, MSW management: Collection, transport, treatment and disposal of MSW. Special MSW: waste from commercial establishments and other urban areas, solid waste from construction activities, biomedical wastes, Effects of solid waste on environment: effects on air, soil, water surface and ground health hazards. Disposal of solid waste-segregation, reduction at source, recovery and recycle. Disposal methods- Integrated solid waste management. Hazardous waste: Types and nature of hazardous waste as per the HW Schedules of regulating authorities.

Course Outcomes:

After successfully studying this course, students will able to:

- Understand the impact of humans on environment and environment on humans
- Identify and value the effect of the pollutants on the environment: atmosphere, water and soil
- Formulate strategies to control, reduce and monitor pollution
- Determine the most appropriate technique for the treatment of water, wastewater solid waste and contaminated air

Books

- Introduction to Environmental Engineering and Science by Gilbert Masters, Prentice Hall, New Jersey.
- Introduction to Environmental Engineering by P. Aarne Vesilind, Susan M. Morgan, Thompson /Brooks/Cole; Second Edition 2008.
- Peavy, H.s, Rowe, D.R, Tchobanoglous, G. Environmental Engineering, Mc-Graw -Hill International Editions, New York 1985.
- MetCalf and Eddy. Wastewater Engineering, Treatment, Disposal and Reuse, Tata McGraw-Hill, New Delhi

MCMC3002 INDUSTRIAL SAFETY ENGINEERING (3-0-0)

Course Objectives:

1. Students will be able to recognize and evaluate occupational safety and health hazards in the workplace, and to determine appropriate hazard controls following the hierarchy of controls.
2. Students will furthermore be able to analyze the effects of workplace exposures, injuries and illnesses, fatalities and the methods to prevent incidents using the hierarchy of controls, effective safety and health management systems and task-oriented training.

Course Outcomes:

By the end of this course, a student should:

CO1: Evaluate workplace to determine the existence of occupational safety and health hazards
CO2: Identify relevant regulatory and national consensus standards along with best practices that are applicable.
CO3: Select appropriate control methodologies based on the hierarchy of controls
CO4: Analyze injury and illness data for trends

Module-I: (07 hrs)

Industrial safety: Accident, causes, types, results and control, mechanical and electrical hazards, types, causes and preventive steps/procedure, describe salient points of factories act 1948 for health and safety, wash rooms, drinking water layouts, light, cleanliness, fire, guarding, pressure vessels, etc, Safety color codes. Fire prevention and firefighting, equipment and methods.

Module-II: (07 hrs)

Fundamentals of maintenance engineering: Definition and aim of maintenance engineering, Primary and secondary functions and responsibility of maintenance department, Types of maintenance, Types and applications of tools used for maintenance, Maintenance cost & its relation with replacement economy, Service life of equipment.

Module-III: (07 hrs)

Wear and Corrosion and their prevention: Wear- types, causes, effects, wear reduction methods, lubricants-types and applications, Lubrication methods, general sketch, working and applications, i. Screw down grease cup, ii. Pressure grease gun, iii. Splash lubrication, iv. Gravity lubrication, v. Wick feed lubrication vi. Side feed lubrication, vii. Ring lubrication, Definition, principle and factors affecting the corrosion. Types of corrosion, corrosion prevention methods.

Module-IV: (07 hrs)

Fault tracing: Fault tracing-concept and importance, decision tree concept, need and applications, sequence of fault-finding activities, show as decision tree, draw decision tree for problems in machine tools, hydraulic, pneumatic, automotive, thermal and electrical equipment's like, I. Any one machine tool, ii. Pump iii. Air compressor, iv. Internal combustion engine, v. Boiler, vi. Electrical motors, Types of faults in machine tools and their general causes.

Module-V: (08 hrs)

Periodic and preventive maintenance: Periodic inspection-concept and need, degreasing, cleaning and repairing schemes, overhauling of mechanical components, overhauling of electrical motor, common troubles and remedies of electric motor, repair complexities and its use, definition, need, steps and advantages of preventive maintenance. Steps/procedure for periodic and preventive maintenance of: I. Machine tools, ii. Pumps, iii. Air compressors, iv. Diesel generating (DG) sets, Program and schedule of preventive maintenance of mechanical and electrical equipment, advantages of preventive maintenance. Repair cycle concept and importance.

Books:

1. Maintenance Engineering Handbook, Higgins & Morrow, Da Information Services.
2. Maintenance Engineering, H. P. Garg, S. Chand and Company.
3. Pump-hydraulic Compressors, Audels, McGraw Hill Publication.
4. Foundation Engineering Handbook, Winterkorn, Hans, Chapman & Hall London.

MEPC3001 DESIGN OF MACHINE ELEMENTS-II (3-0-0)

Course Objectives:
This course focuses on advanced machine element design, covering stress analysis, fatigue failure theories, and component design (cylinders, pistons, gears). Students will learn to design power transmission elements (belts, chains, clutches, brakes) and apply engineering principles to solve practical problems using design handbooks and failure criteria (Goodman, Soderberg).

Module–I: (06 Hours)
Review of axial, bending and torsional stresses in machine parts; Theories of Failure, Applications in practical problems.
Variables stresses (Fatigue), Endurance limit, S-N curve, Fatigue stress concentration factor, Goodman, Gerber and Soderberg criteria, Application to design and practical problems.

Module–II: (06 Hours)
Design of cylinder, piston, connecting rod, flywheel, crank shaft and valve.

Module–III: (06 Hours)
Design of clutches (friction and centrifugal type), Brakes (block, band brakes and internal expanding brake).

Module-IV: (06 Hours)
Design of belts (flat and V-belt), rope and chain drives.

Module–V: (06 Hours)
Design of straight and helical spur gears, bevel gears and worm gears.

Course Outcomes:
CO1: Remembering (Knowledge): Recall fundamental principles of stress analysis (axial, bending, torsional) and theories of failure (Goodman, Gerber, Soderberg) for machine components.
CO2: Understanding (Comprehension): Explain the design considerations for cylinders, pistons, gears, and power transmission elements (belts, chains, clutches, brakes) based on load and fatigue analysis.
CO3: Applying (Application): Design machine elements (e.g., gears, flywheels, brakes) using standard design handbooks and failure criteria to meet functional requirements.
CO4: Analyzing (Analysis): Evaluate the impact of variable stresses, fatigue, and stress concentration factors on the performance and lifespan of machine components.
CO5: Creating (Synthesis): Develop integrated solutions for real-world mechanical systems by combining multiple machine elements (e.g., gear drives with shafts) and optimizing designs for safety and efficiency.

Design Data Hand Books:

1. Design Hand Book by S. M. Jalaluddin; Anuradha Agencies Publications
2. P. S. G. Design Data Hand Book, PSG College of Tech Coimbatore
3. Machine Design Data Book, K. Lingaiah, Tata McGraw Hill

Reference Books:

1. Design of Machine Elements, V. B. Bhandari, Tata McGraw Hill Publishing Company Ltd., New Delhi, 3rd Edition
2. Mechanical Engineering Design, J. E. Shigley, C. R. Mischke, R. G. Budynas and K. J. Nisbett, Tata Mc Graw-Hill, 11th Edition, 2020
3. Design of Machine Elements, M. F. Spotts
4. Machine Design, P. C. Sharma and D. K. Agrawal, S. K. Kataria & Sons
5. Machine Design, Robert L. Norton, Pearson Education Asia, 2001.
6. Fundamentals of Machine Component Design, Robert C. Juvinall and Kurt M Marshek, Wiley India Pvt. Ltd., New Delhi, 3 rd Edition, 2007
7. Machine Design, P. Kanaiah, SciTech Publications.

MEPC3002 HEAT TRANSFER (3-0-0)

Course Objectives:
This course provides a comprehensive understanding of heat transfer mechanisms—conduction, convection, and radiation. Students will analyze steady/transient heat conduction, convective heat transfer (forced/natural), radiative exchange, and phase-change processes. Emphasis is placed on solving engineering problems, designing heat exchangers, and applying empirical correlations for real-world thermal systems.

Module-I: (06 Hours)
Introduction: Modes of heat transfer: conduction, convection, and radiation, Mechanism & basic laws governing conduction, convection, and radiation heat transfer; Thermal conductivity, Thermal conductance & Thermal resistance, Contact resistance, convective heat transfer coefficient, radiation heat transfer coefficient, Electrical analogy, combined modes of heat transfer. Initial conditions and Boundary conditions of 1st, 2nd and 3rd Kind.

Module-II: (06 Hours)
Heat Conduction: General heat conduction in Cartesian, polar-cylindrical and polar-spherical coordinates, Simplification of the general equation for one- and two-dimensional steady transient conduction with constant/ variable thermal conductivity with / without heat generation. Solution of the one-dimensional steady state heat conduction problem in case of plane walls, cylinders and spheres for simple and composite cases. Critical insulation thickness, Heat transfer in extended surfaces (pin fins) without heat generation, long fin, short fin with insulated tip and without insulated tip and fin connected between two heat sources. Fin efficiency and fin effectiveness. Conduction in solids with negligible internal temperature gradient (Lumped heat analysis).

Module-III: (06 Hours)
Convective Heat Transfer: Introduction to convective flow - forced and free. Dimensional analysis of forced and free connective heat transfer. Application of dimensional analysis, physical significance of Grashoff, Reynolds, Prandtl, Nusselt and Stanton numbers. Conservation equations for mass, momentum and energy for 2-dimensional convective heat transfer in case of incompressible flow, Hydrodynamic and thermal boundary layers for flow over a flat plate. Critical Reynolds number: general expressions for drag coefficient and drag force Reynolds- Colbourn analogy. Thermal boundary layer; general expression for local heat transfer coefficient; Average heat transfer Coefficient; Nusselt number. Flow inside a duct- velocity boundary layer, hydrodynamic entrance length and hydrodynamically developed flow; flow through tubes (internal flow). Use of empirical relations for solving turbulent conditions for external and internal flow. Mechanism of heat transfer during natural convection, Experimental heat transfer correlations for natural convection in the following cases(a) Vertical and horizontal plates(b) Inside and outside flows in case of tubes.

Module-IV: (06 Hours)
Radiative heat exchange: Introduction, Radiation properties, definitions of various terms used in radiation heat transfer; Absorptivity, reflectivity & transmissivity. Emissive power & emissivity, Kirchoff's identity, Planck's relation for monochromatic emissive power of a black body, Derivation of Stefan-Boltzmann law and Wien's displacement law from Planck's relation, Radiation shape factor, Relation for shape factor and shape factor algebra. Heat exchange between blackbodies through non-absorbing medium. Gray bodies and real bodies, Heat exchange between gray bodies. Radiosity and Irradiation, Radiation shields.

Module-V: (06 Hours)
Heat transfer for boiling liquids and condensing vapors: Types of condensation, use of correlations for condensation on vertical flat surfaces, horizontal tube and regimes of pool boiling, pool boiling correlations. Critical heat flux, concept of forced boiling. Numerical problems.

Heat Exchangers: Introduction, Types of heat exchanger, The overall heat transfer coefficient and fouling factors, LMTD and NTU analysis of heat exchangers.

Course Outcomes:
CO1: Remembering (Knowledge): Recall fundamental laws (Fourier's, Newton's cooling, Stefan-Boltzmann) and modes of heat transfer (conduction, convection, radiation).

CO2: Understanding (Comprehension): Explain concepts like boundary layers, fin efficiency, and shape factors, and interpret dimensionless numbers (Reynolds, Nusselt, Grashof).
CO3: Applying (Application): Solve problems involving steady/transient conduction, convective heat transfer, and radiative exchange using empirical correlations and LMTD/NTU methods.
CO4: Analyzing (Analysis): Evaluate the impact of variables (e.g., insulation thickness, flow conditions) on heat transfer rates and system performance.
CO5: Creating (Synthesis): Design heat exchangers and thermal systems by integrating conduction, convection, and radiation principles for optimal efficiency.

Reference Books:

1. Heat Transfer Incropera and Dewitt, Willey publications
2. Heat Transfer: J.P.Holman, TMH Publications
3. Heat Transfer: P.S. Ghosdastidar, Oxford University Press
4. Fundamentals of Engineering Heat and Mass Transfer: R.C. Sachdeva, New Age International Publishers, 4th Edition.
5. Heat Transfer by P.K. Nag, TMH
6. Heat Transfer by S.P. Sukhatme, TMH
7. Heat Transfer: A.F. Mills and V. Ganesan, Pearson Education, 2nd Edition
8. Heat and Mass Transfer: Domkundwar and Arora, Danpatrai and sons
9. Heat Transfer: R. K. Rajput, Laxmi Publications
10. Heat and Mass Transfer: A Practical Approach, Y.A. Cengel, Tata Macgraw Hills Education Private Limited

MEPC3003 METAL CUTTING & MACHINING (3-0-0)

Course Objectives:
This course explores metal cutting principles, tool geometry, and machining processes (conventional and non-traditional). Students will analyze tool wear, cutting forces, and machinability criteria, and apply Taylor's tool life equation. Emphasis is placed on machine tool operations, CNC technology, and advanced processes like EDM, laser machining, and ultrasonic machining.

Module – I: (06 Hours)
Geometry of cutting tools in ASA and ORS, Effect of Geometrical parameters on cutting force and surface finish, Mechanics of chip formation, Merchant's theory, Force relationship and velocity relationship, Cutting tool materials. Types of Tool Wear: Flank wear, Crater wear, Wear measurement, Temperature in metal Cutting, Cutting fluid and its effect.

Module – II: (06 Hours)
Machinability Criteria, Tool life and Taylor's equation, Effect of variables on tool life and surface finish, Measurement of cutting force, Lathe tool dynamometer, and Drill tool dynamometer. Economics of machining: Minimum cost, Maximum production and Maximum profit rate.

Module – III: (06 Hours)
Conventional machining process and machine tools: Turning, Drilling, Shaping, Planning, Milling, Grinding. Machine tools used for these processes, their specifications and various techniques used.

Module – IV: (06 Hours)
Tool holding and job holding methods in different Machine tools, Types of surface generated. Production Machine tools: Capstan and turret lathes, single spindle and multi spindle semiautomatics, CNC Machine tools.

Module – V: (06 Hours)
Non-traditional Machining processes: Ultrasonic Machining, Electro Chemical Machining, EDM, Wire EDM, Abrasive Jet Machining, Plasma Arc Machining and Laser Beam Machining.

Course Outcomes:
CO1: Remembering (Knowledge): Recall tool geometry systems (ASA, ORS), types of tool wear, and fundamentals of chip formation.
CO2: Understanding (Comprehension): Explain the impact of tool geometry, cutting fluids, and variables on tool life and surface finish.
CO3: Applying (Application): Calculate tool life using Taylor's equation and analyze cutting forces using dynamometers.
CO4: Analyzing (Analysis): Compare conventional and non-traditional machining processes (e.g., EDM, laser) based on efficiency, precision, and applications.
CO5: Creating (Synthesis): Design machining strategies for cost-effective production, integrating CNC and advanced processes for complex geometries.

Reference Books

1. A Bhattacharryya, Metal Cutting, Theory and Practice, New Central Book Agency (p) Ltd, 1st Edition, 2022.
2. A B Chattopadhyay, Machining and Machining tool, Wiley Publisher, 2nd. Edition, 2021.
3. Sreeramulu Moinikunta, Production Technology, Volume 2, Wiley Publisher, 1st. Edition 2019.
4. P. K. Mishra, Nonconventional Machining, Narosa Publishing House, 2007.
5. Production Technology HMT, Tata McGraw Hill, 2001.
6. M. C. Shaw, Metal Cutting Principles, Second Edition, Oxford University Press, 2005.

MEPC3201 DESIGN OF MACHINE ELEMENTS-II LABORATORY (0-0-3)

Course Objectives:

This laboratory course provides hands-on experience in designing critical machine elements such as cranks, pistons, shafts, clutches, brakes, and gear systems. Students will apply theories of failure and fatigue analysis to solve practical design problems, reinforcing theoretical concepts through computational and analytical exercises.

1. Problems for practice on theories of failure.
2. Problems for practice on fatigue failure.
3. Design of crank piston and cylinder.
4. Design of connecting rod and shaft.
5. Design of clutches.
6. Design of Brakes (block, band brakes and internal expanding brake)
7. Design of belts, rope and chain drives
8. Design of Spur/ Bevel/ Helical gear.

Course Outcomes:

CO1: Remembering (Knowledge): Recall theories of failure (e.g., Von Mises, Soderberg) and fatigue analysis principles.

CO2: Understanding (Comprehension): Explain the design considerations for machine elements like cranks, pistons, and gears under dynamic loads.

CO3: Applying (Application): Perform calculations to design clutches, brakes, and power transmission elements (belts, chains, gears).

CO4: Analyzing (Analysis): Evaluate the impact of load conditions and material properties on the performance of machine components.

CO5: Creating (Synthesis): Develop optimized designs for machine elements by integrating failure theories and practical constraints.

MEPC3202 MACHINING LABORATORY (0-0-3)

Course Objectives:

This laboratory course provides hands-on experience in fundamental machining operations, including turning, milling, grinding, and threading. Students will analyze tool geometry (ASA/ORS systems), measure cutting forces, and evaluate the role of coolants. Emphasis is placed on practical skills for operating lathes, milling machines, and grinders to manufacture precision components.

List of Experiments:

1. A study on tool geometry in both ASA and ORS system.
2. Preparation of a threaded joint using drilling and tapping operations.
3. Perform operations like taper turning, thread cutting, knurling and groove cutting on a lathe machine.
4. Determine the cutting forces during turning of a cylindrical component in lathe machine.
5. Perform the gear cutting on milling machine.
6. Working with shaper/planer/slotting machine.
7. Working with surface and cylindrical grinding machine.
8. A study on the importance of coolant during machining.

Course Outcomes:

CO1: Remembering (Knowledge): Identify tool geometry systems (ASA, ORS) and components of machining tools (e.g., lathe, milling machine).

CO2: Understanding (Comprehension): Explain the principles of operations like taper turning, thread cutting, and gear milling.

CO3: Applying (Application): Perform machining operations (drilling, tapping, grinding) and measure cutting forces using instrumentation.

CO4: Analyzing (Analysis): Compare the effects of coolants and cutting parameters on surface finish and tool life.

CO5: Creating (Synthesis): Manufacture components by integrating multiple machining processes (e.g., turning + threading) to meet design specifications.

MEPC3203 SOFT COMPUTING LABORATORY (0-0-3)

Course Objectives:

This laboratory course introduces soft computing techniques (fuzzy logic, neural networks, genetic algorithms) using MATLAB/Python. Students will design fuzzy systems, implement perceptron models, and solve optimization problems (e.g., truss design). Emphasis is placed on hybrid systems (GA-ANN/Fuzzy) and real-world applications like thermal modeling and robotics path planning.

List of Experiments

1. Introduction to MATLAB/Python Fuzzy Logic Toolbox / scikit-fuzzy - Create a simple fuzzy inference system (FIS).
2. Application of Fuzzy Logic in Mechanical Systems
3. Introduction to Neural Networks in MATLAB / Python (Tensor Flow/Keras) - Implement a Perceptron model.
4. ANN Application in Mechanical Engineering
5. Introduction to Genetic Algorithms - Implement a basic GA using MATLAB / Python (DEAP library).
6. Solving Optimization Problems using GA - Example: Design optimization (truss structure, spring, or shaft design).
7. Hybrid Soft Computing Systems - Combining GA with ANN/Fuzzy for performance enhancement.
8. Case Study / Mini Project - Example: Thermal system modeling, CFD optimization, or Robotics path planning etc.
9. Simulation and Analysis of Soft Computing Models - Test performance, compare models, and analyze real data.

Course Outcomes:

CO1: Remembering (Knowledge): Recall fundamentals of fuzzy logic, neural networks, and genetic algorithms.
CO2: Understanding (Comprehension): Explain the working principles of FIS, perceptrons, and GA optimization.
CO3: Applying (Application): Implement soft computing models (FIS, ANN, GA) to solve mechanical engineering problems.
CO4: Analyzing (Analysis): Compare performance of different soft computing techniques for specific applications.
CO5: Creating (Synthesis): Develop hybrid systems (e.g., GA-Fuzzy) for enhanced performance in case studies like CFD optimization.

MEPE3001 OPTIMIZATION METHOD IN ENGINEERING DESIGN (3-0-0)

Course Objectives:
This course introduces optimization techniques for engineering design, covering linear/nonlinear programming, multivariable algorithms, and global methods (GA, simulated annealing). Students will learn to formulate problems (variables, constraints, objectives) and apply methods like simplex, Fibonacci search, and Kuhn-Tucker conditions to solve real-world engineering challenges.

Module-I: (06 Hours)
Introduction and overview of optimization- Definition, Design variables, Constraints, Objective function, Classification of problems; Single-many variable problems, Single-many objectives problem.

Module-II: (06 Hours)
Single variable optimization algorithm, Linear programming, Simplex and BIG M method.

Module-III: (06 Hours)
Nonlinear Programming- Elimination methods, Exhaustive Search Method, Fibonacci Search method, Golden section search method, Cubic Search Method, Newton-Raphson method, Secant Method.

Module-IV: (06 Hours)
Multivariable Optimization Algorithms- Direct search methods. Simplex search method and Hooke- Jeeves pattern search method. Constrained Optimization Algorithms- Kuhn-Tucker conditions, penalty function.

Module-V: (06 Hours)
Global optimization using genetic algorithms and simulated annealing.

Course Outcomes:
CO1: Remembering (Knowledge): Define optimization terms (variables, constraints, objectives) and classify problem types.
CO2: Understanding (Comprehension): Explain linear/nonlinear programming methods (simplex, BIG M) and search algorithms (Fibonacci, Golden section).
CO3: Applying (Application): Implement single/multivariable optimization techniques (e.g., Hooke-Jeeves) for engineering problems.
CO4: Analyzing (Analysis): Evaluate constrained optimization solutions using Kuhn-Tucker conditions and penalty functions.
CO5: Creating (Synthesis): Design global optimization strategies using genetic algorithms or simulated annealing for complex systems.

Reference Books

1. Engineering Optimization: Theory and Practice- S.S. Rao
2. Optimization Methods for Engineering Design- R.L. Fox
3. Optimization methods- K. V. Mital and C. Mohan
4. Optimization and Probability in System Engineering- J.G. Rau

MEPE3002 METROLOGY, QUALITY CONTROL AND RELIABILITY (3-0-0)

Course Objectives:
This course covers metrology principles, quality control techniques, and reliability engineering. Students will learn about measurement systems, tolerances, control charts, sampling plans, and Taguchi methods. Emphasis is placed on statistical quality control, ISO standards, and reliability analysis (MTTF, MTBF) to ensure product quality and performance in manufacturing.

Module-I: (08 Hours)
Metrology: Need of Inspection, Precision and accuracy, Sources of error, Types of error. Line standard, end standard, limits, fits, tolerances, Hole & shaft basis system, Interchangeability, selective assembly, ISO system for limits & fits, Limit gauges-Snap, plug, ring, taper, position gauges-Gauge design, Taylor's principle.

Module-II: (06 Hours)
Comparators- Characteristics, Relative Advantages of various types of comparators, Mechanical, optical, Pneumatic, Fluid displacement type, Measurement by light wave Interference.

Module-III: (06 Hours)
Control charts for variable (X,R,S, CUSUM, EWMA), Control charts for fraction, non-conforming control charts for non-conformation.

Module-IV: (05 Hours)
Design of single sampling plan. Double, multiple and sequential sampling plans, O.C. curve, AOQ, AOQL, Taguchi's Loss function, Orthogonal Arrays, Linear Graphs, parametric design, signal-to noise Ratio, ANOVA, TQM, Taguchi, ISO 9000, ZIT, Quality circle.

MODULE-V: (05 Hours)
Bath-tub-curve, system reliability, reliability improvement, maintainability and availability, Availability of single repairable system using Markov model, Life tests, acceptance sampling plan based on life tests, Sequential acceptance sampling plan based on MTTF & MTBF.

Course Outcomes:
CO1: Remembering (Knowledge): Define metrology terms (precision, accuracy, tolerances) and recall ISO standards for limits and fits.
CO2: Understanding (Comprehension): Explain the working principles of comparators (mechanical, optical, pneumatic) and Taguchi's loss function.
CO3: Applying (Application): Construct control charts (X, R, CUSUM) and design sampling plans (single/double) for quality assessment.
CO4: Analyzing (Analysis): Evaluate system reliability using bath-tub curves and Markov models for repairable systems.
CO5: Creating (Synthesis): Develop quality improvement strategies using ANOVA, orthogonal arrays, and TQM principles.

Reference Books:

1. Engineering Metrology- R.K. Jain
2. Engineering Metrology and Measurement- K. Duraivelu and S. Karthikeyan
3. Introduction to Statistical Quality control- D.C. Montgonery
4. Statistical Quality Control- M. Mahajan & Dhanpat Rai
5. Production Technology- P.C. Sharma

MEPE3003 PRODUCTION AND OPERATION MANAGEMENT (3-0-0)

Course Objectives:

1. To impart fundamental knowledge of production and operations functions in manufacturing and service organizations.
2. To expose students to production planning, process design, facility layout, and scheduling.
3. To equip students with inventory and quality control techniques used in operations management.
4. To understand lean, ERP, forecasting, and optimization tools for process efficiency.

Module-I Introduction to Production & Operations Management(07 Hours)

Nature, scope and objectives of POM. Evolution of production systems (craft, mass, lean production). Interface with marketing, finance, HR, R&D, and supply chain. Characteristics of manufacturing vs service operations. Role of operations manager; decision types in operations. Trends: Industry 4.0, sustainability, AI in operations. Basics of Operations Research and its application in decision-making.

Module-II Production & Operation Systems (09 Hours)

Types of production systems: job shop, batch production, mass production, continuous flow. Characteristics, advantages, and limitations of each system. Automation in production: types, role of robotics and IoT. Overview of Computer Aided Design (CAD) and Computer Aided Manufacturing (CAM). Facility location decisions: qualitative and quantitative models, break-even analysis. Capacity planning: definition, types (design, effective, actual), tools and capacity requirement planning (CRP).

Module-III Production & Operations Planning (09 Hours)

Plant layout types: product, process, cellular, fixed-position. Facility layout planning tools: block diagramming, relationship charts (REL), CRAFT. Production process planning: routing, sequencing, scheduling. Production Planning and Control (PPC): functions, phases (pre-planning, planning, control). Aggregate Production Planning (APP): objectives, strategies (chase, level, mixed). Master Production Schedule (MPS) and capacity utilization. Tools for resource allocation: linear programming (overview).

Module-IV Operations Management Processes (09 Hours)

Process selection strategies and process lifecycle. Work study:
Method study: process chart symbols, flow process charts. Time study: stopwatch method, standard time calculation.
Value engineering and value analysis: definition, procedure, benefits. Materials Requirement Planning (MRP I) and MRP II: logic and structure. TOC (Theory of Constraints) and Critical Chain Project Management (CCPM). Line balancing: objectives, heuristics, practical examples. Forecasting: types (qualitative vs quantitative), methods (moving average, exponential smoothing, regression models).

Module-V Controlling Production & Operations (09 Hours)

Inventory functions, types and classification. Inventory models: EOQ (Economic Order Quantity), reorder point, safety stock. Inventory management techniques: ABC, VED, FSN, JIT (Just-in-Time). Introduction to ERP systems and modules in production. Maintenance strategies: preventive, predictive, and breakdown maintenance. Statistical Quality Control (SQC): Control charts for variables ($\bar{X}$ and R), Control charts for attributes (p, np, c charts). Introduction to Total Quality Management (TQM), Six Sigma, and Kaizen. Principles of Lean Manufacturing and overview of SCM (Supply Chain Management).

Course Outcomes:

On successful completion of the course, students will be able to:

CO1: Describe the role and scope of operations management in manufacturing and service sectors.
CO2: Classify production systems and apply methods for facility and capacity planning.
CO3: Formulate production plans and layouts using planning techniques and decision tools.
CO4: Apply work study and forecasting techniques to improve productivity.
CO5: Use quality and inventory management tools for effective control and continuous improvement.

Textbooks:

1. Kanishka Bedi, Production and Operations Management, Oxford University Press.
2. Martand Telsang, Industrial Engineering and Production Management, S. Chand & Co.
3. Norman Gaither and G. Frazier, Operations Management, Thomson Learning.

Reference Books:

1. S.N. Chary, Production and Operations Management, Tata McGraw Hill.
2. B. Mahadevan, Operations Management – Theory and Practice, Pearson Education.
3. William Stevenson, Operations Management, McGraw Hill.

MEPE3004 REFRIGERATION AND AIR CONDITIONING (3-0-0)

Course Objectives:

This course provides fundamental knowledge of refrigeration and air conditioning systems, covering vapor compression/absorption cycles, psychrometrics, and comfort air conditioning. Students will analyze system performance (COP, cooling load), compare refrigerants, and design HVAC solutions for diverse applications, including multi-stage systems and thermoelectric refrigeration.

Module-I: (05 Hours)

Air Refrigeration System: Introduction, Unit of refrigeration, Coefficient of performance, Reversed Carnot Cycle, Temperature limitations, maximum COP, Bell Coleman air cycle, Simple Air Cycle System for Aircraft with problems.

Module-II: (06 Hours)

Vapour Compression System: Analysis of theoretical vapour compression cycle, Representation of cycle on T - S and p - h diagram, Simple saturation cycle, subcooled cycle and super-heated cycle, Effect of suction and discharge pressure on performance, Actual vapour compression cycle. Problem illustration and solution.

Multi-stage compression and multi-evaporator systems: Different arrangements of compressors and inter-cooling, Multistage compression with inter-cooling, multi-evaporator system, Dual compression system. Simple problems

Module-III: (8 Hours)

Vapour Absorption System: Simple Ammonia - absorption system, Improved absorption system, Analysis of vapour absorption system (Specifically of analyzing coloumn and rectifier), Electrolux / Three fluid system, Lithium bromide-water vapour absorption system, comparison of absorption system with vapour compression system. Simple Problems and solutions.

Thermoelectric Refrigeration:

Basics and Principle. Defining the figure of Merit. (No Problem)

Refrigerants: Classification of refrigerants and its designation- Halocarbon (compounds, Hydrocarbons, Inorganic compounds, Azeotropes), Properties of refrigerants, comparison of common refrigerants, uses of important refrigerants, Brines. Alternative refrigerants (Organic and inorganic compounds).

Module-IV: (06 Hours)

Psychometrics: Properties of air-vapour mixture, Law of water vapour-air mixture, Enthalpy of moisture, Psychrometric chart, simple heating and cooling, Humidification, De-humidification, Mixture of air streams. Review question and discussions

Requirements of comfort air conditioning: Oxygen supply, Heat removal, moisture removal, air motion, purity of air, Thermodynamics of human body, comfort and comfort chart, effective temperature, factors governing optimum effective temperature

Module-V: (05 Hours)

Air Conditioning System: Process in air conditioning, Summer air conditioning, Winter air conditioning and year-round air conditioning, Cooling load calculations. Review question and discussions.

Course Outcomes:

CO1: Remembering (Knowledge): Define key terms (COP, effective temperature) and classify refrigerants (halocarbons, azeotropes).

CO2: Understanding (Comprehension): Explain vapor compression/absorption cycles, psychrometric processes, and comfort chart principles.

CO3: Applying (Application): Calculate cooling loads, system performance (COP), and analyze multi-stage compression/inter-cooling setups.

CO4: Analyzing (Analysis): Evaluate refrigerant properties and compare system efficiencies (absorption vs. compression, thermoelectric).

CO5: Creating (Synthesis): Design HVAC systems (summer/winter/year-round) integrating psychrometrics and load calculations for optimal performance.

Textbooks:

1. Refrigeration and Air Conditioning by R.C. Arora, PHI Publication
2. Refrigeration and Air Conditioning by S.C. Arora and S. Domkundwar, Dhanpat Rai & Sons. Chapters; 3,4,5,6,7,11,16,17,19,20
3. Refrigeration and Airconditioning Data book by Manohar Prasad

Reference Books:

1. Refrigeration and Air conditioning by P.L. Balloney, Khanna Publishers.
2. Refrigeration and Air conditioning by Manohar Prasad, New Age international publishers.
3. Refrigeration and Air conditioning by C.P. Arora, Tata McGraw Hill.

MEPE3005 ADVANCED MECHANICS OF SOLIDS (3-0-0)

Course Objectives:
This course explores advanced concepts in solid mechanics, including 3D stress-strain analysis, unsymmetrical bending, torsion of non-circular shafts, rotating disc design, and curved beam theory. Students will apply mathematical models (Mohr's circle, Winkler-Bach formula) to solve complex engineering problems involving stress distribution and structural integrity.

Module – I: (06 hours)
Introduction: Elementary concept of elasticity, stresses in three dimensions, Principal Stresses, Stress Invariants, Mohr's Circle for 3-D state of stress, Octahedral Stresses, State of pure shear, Differential equations of equilibrium and compatibility conditions, plane stress. Analysis of strain, State of strain at a point, Strain Invariant, Principal Strains, Plane state of strain, Strain measurements.

Module – II: (06 hours)
Unsymmetrical Bending and Shear Centre: Introduction; product of inertia – parallel axes theorem for product of inertia – principal axes and principal moments of inertia; bending stresses in beams due to unsymmetrical bending; deflection of straight beams due to unsymmetrical bending. Concept of shear center; determination of shear center for symmetrical and unsymmetrical sections.

Module – III: (06 hours)
Torsion Of Non-Circular Shafts: Introduction; Membrane Analalogy; torsion of non-circular solidsections; thin wall tubular sections; thin-walled multi-cell sections.

Module – IV: (06 hours)
Design Of Rotating Discs: Introduction to Centrifugal stresses- Rotating ring; flat discs-Disc of uniform thickness and Disc of uniform strength.

Module – V: (06 hours)
Curved Beam Theory: Winkler bach formula for circumferntial stresses – Limitations; corrections factors – Radial stress in curved beams – closed rings subjected to concentrated and uniform loads.

Course Outcomes:
CO1: Remembering (Knowledge): Recall stress invariants, strain measurements, and key formulas (Winkler-Bach, Mohr's circle for 3D stress).
CO2: Understanding (Comprehension): Explain unsymmetrical bending, shear center determination, and membrane analogy for torsion.
CO3: Applying (Application): Calculate stresses in rotating discs (uniform thickness/strength) and curved beams under concentrated loads.
CO4: Analyzing (Analysis): Evaluate principal stresses/strains and compatibility conditions for 3D elasticity problems.
CO5: Creating (Synthesis): Design structural components (shafts, beams) by integrating advanced mechanics principles for optimal performance.

Reference Books:

1. Boresi, "Advanced Mechanics of Materials", 6th Edition, John Wiley and Sons, 2003.
2. Timoshenko and S. Woinowsky - Krieger, "Theory of Plates and Shells", 2nd Edition, Tata Mc Graw Hill, 2010.
3. J.P. Den Hartog, "Advanced Strength of Materials", 1st Edition, Dover Publications, 1987.
4. L.S. Srinath, "Advanced Solid Mechanics", 3rd Edition, Tata Mc Graw Hill, 2009.
5. R.K. Rajput, "Strength of Materials", 3rd Edition, S. Chand Publications, 2007.
6. B.C. Punmia, "Strength of Materials and Theory of Structures",12th Edition, Lakshmi Publications, 2004.

BIJU PATNAIK UNIVERSITY OF TECHNOLOGY, ODISHA

ROURKELA

Curriculum and Syllabus

B. Tech (*Mechanical Engineering*) from the Admission Batch

2018-19

Semester (6th)

Sixth Semester							
Theory							
Sl. No.	**Category**	**Course Code**	**Course Title**	**L-T-P**	**Credit**	**University Marks**	**Internal Evaluation**
1	PC	RME6C001	Design of Machine Elements	3-0-0	3	100	50
2	PC	RME6C002	Machining Science and Technology	3-0-0	3	100	50
3	BS		Optimization in Engineering	3-0-0	3	100	50
4	PE	RME6D001	Smart and Composite Materials	3-0-0	3	100	50
		RME6D002	Compressible Flow and Gas Dynamics	3-0-0			
		RME6D003	Computer Integrated Manufacturing and FMS	3-0-0			
5	OE		Artificial Intelligence and Machine Learning	3-0-0	3	100	50
			Electrical Energy Conservation and Auditing	3-0-0			
			Control System	3-0-0			
6	MC*	RIK6F001	Essence of Indian Knowledge Tradition - I	3-0-0	0	-	100 (Pass mark is 37)
Total Credit (Theory)					**15**		
Total Marks						**500**	**250**
Practical							
1	PC	RME6C201	Design of Machine Elements Lab	0-0-3	2		100
2	PC	RME6C202	Machining Science and Technology Lab	0-0-3	2		100
3	PSI		Future Ready Contributor Program	0-0-3	2		100
4	PSI		Seminar - I	0-0-3	1		100
Total Credit (Practical)					**7**		
Total Semester Credit					**22**		
Total Marks							**400**
SUMMER INTERNSHIP TRAINING FOR 45 DAYS							

***Mandatory Non-Credit Courses (MC) result will be reflected with Pass (P) / Fail (F) grade. Thus the grade obtained will not be affecting the grade point average. However it shall appear on the grade sheet as per AICTE rule.**

6th Semester	RME6C001	Design of Machine Elements	L-T-P 3-0-0	3 Credits

Module - I **(10 Lectures)**

1. Mechanical engineering design: Introduction to design procedure, Stages in design, Code andStandardization, Interchangeability, Preferred numbers, Fits and Tolerances, Engineeringmaterials: Ferrous, Non-ferrous, Non-metals, design requirements – properties of materials,Material selection, Use of Data books.

2. Fundamentals of Machine Design: Types of load, Modes of failure, factor of safety concepts,Theories of Failure, concept and mitigation of stress concentration, Fatigue failure and curve,endurance limit and factors affecting it, Notch sensitivity, Goodman, Gerber and Soderberg criteria.

Module – II **(08 Lectures)**

3. Machine Element Design: Design of Joints: Rivets, welds and threaded fasteners based on different types of loading, Boiler joints, cotter joints and knuckle joints.

Module – III **(10 Lectures)**

4. Design of Keys, Shaft and Couplings: Classification of keys and pins, Design of keys and pins, Theories of failure, Design of shafts: based on strength, torsional rigidity and fluctuating load, ASME code for shaft design, Design of couplings: Rigid coupling, Flexible coupling.

5. Design of Mechanical Springs: Types of helical springs, Design of Helical springs, bulking of spring, spring surge, end condition of springs, Design of leaf springs: nipping.

Module – IV **(08 Lectures)**

6. Bearings: Types and selection of ball and roller bearings, Dynamic and static load ratings, Bearing life, Design of sliding contact bearings, Journal bearing, foot step bearing.

Books:

1. Design of Machine Elements, V.B. Bhandari, Tata McGraw Hill
2. Mechanical Engineering Design, J.E.Shigley, C.R.Mischke, R.G.Budynas and K.J.Nisbett, TMH
3. Machine Design, Pandya and Shah, Charotar Book Stall
4. Fundamentals of Machine Component Design by R.C.Juvinall and K.M.Marshek, John Wiley & Sons.
5. Machine Drawing by N.Sidheswar, McGraw-Hill
6. Machine Design, P.C.Sharma and D.K.Agrawal, S.K.Kataria& Sons
7. Machine Design, P. Kanaiah, Scietech Publications
8. Machine Design, Robert L. Norton, Pearson Education Asia.
9. Design of Machine Elements by C. S. Sharma and K. Purohit, PHI

DESIGN DATA HAND BOOKS:

1. Design Hand Book by S.M.Jalaluddin, Anuradha Agencies Publications
2. P.S.G. Design Data Hand Book, PSG College of Tech Coimbature
2. Design Data Hand Book, K. Lingaiah, McGraw Hill, 2nd Ed. 2003.
3. Design Data Hand Book by K.Mahadevan and B.Reddy,CBS Publishers

6th Semester	RME6C002	Machining Science and Technology	L-T-P 3-0-0	3 Credits

MODULE – I **(13 HOURS)**

Geometry of cutting tools in ASA and ORS, Effect of Geometrical parameters on cutting force andsurface finish, Mechanics of chip formation, Merchant's theory, Force relationship and velocityrelationship, Cutting tool materials. Types of Tool Wear: Flank wear, Crater wear, Wearmeasurement, Cutting fluid and its effect; Machinability Criteria, Tool life and Taylor's equation,Effect of variables on tool life and surface finish, Measurement of cutting force, Lathe tooldynamometer, Drill tool dynamometer. Economics of machining.

MODULE II **(13 HOURS)**

Conventional machining process and machine tools – Turning, Drilling, Shaping, Planning, Milling,Grinding. Machine tools used for these processes, their specifications and various techniques used.Principles of machine tools : Kinematics of machine tools, speed transmission from motor to spindle, speed reversal mechanism, mechanism for feed motion, Tool holding and job holding methods indifferent Machine tools, Types of surface generated, Indexing mechanism and thread cuttingmechanism, Quick return mechanism

Production Machine tools – Capstan and turret lathes, single spindle and multi spindlesemiautomatics, Gear shaper and Gear hobbing machines, Copying lathe and transfer machine

MODULE III **(10 HOURS)**

Non-traditional Machining processes :

Ultrasonic Machining, Laser Beam Machining, Plasma Arc Machining, Electro Chemical Machining,Electro Discharge Machining, Wire EDM , Abrasive Jet Machining

Books :

3. Fundamentals of Machining and Machine Tools, G.Boothroyd and W.A.Knight, CRC Press
2. Metal Cutting Principles, M.C.Shaw, Oxford University Press
1. Metal Cutting Theory and Practice, A.Bhattacharya, Central Book Publishers
4. Manufacturing Technology – by P.N.Rao, Tata McGraw Hill publication.
5. Modern Manufacturing Processes, P.C.Pandey, H.S.Shan, Tata McGraw Hill
6. Manufacturing Science, Ghosh and Mallik, East West Press.
7. Metal Cutting Theory and Practice, D.A.Stephenson and J.S.Agapiou, CRC Press
8. Machining Technology; Machine Tools and Operation, H.A.Youssef and H. El-Hofy, CRC Press
9. Machine Tools and Manufacturing Technology, Krar, Rapisarda and Check, Cengage Learning
10. Technology of Machine Tools, Krar, Gill and Smidt, Tata McGraw Hill
11. Principles of Metal Cutting, G.Kuppuswamy, Universities Press
12. Metal Cutting and Machne Tools, G.T.Reddy, Scitech
13. Fundamentals of tool Engineering Design, S.K.Basu, S.K.Mukherjee, R. Mishra , Oxford & IBH Pub Co.
14. Machine Tools, R.N.Datta, New Central Book Agency

Course Name: Machining Science

Course Lik: https://onlinecourses.nptel.ac.in/noc21_me39/preview

Course Instructor: Prof. Sounak Kumar Choudhury, IIT Kanpur

Course Name: Mechanics of Machining

Course Lik: https://onlinecourses.nptel.ac.in/noc21_me29/preview

Course Instructor: Prof. Uday S. Dixit, IIT Guwahati.

6th Semester		Optimization in Engineering	L-T-P 3-0-0	3 Credits

Module I: **(10 Hours)**

Idea of Engineering optimization problems, Classification of optimizationalgorithms, modeling of problems and principle of modeling. Linear Programming:Formulation of LPP, Graphical solution, Simplex method, Big-M method, Revised simplex method, Duality theory and its application, Dual simplex method , Sensitivity analysis in linear programming.

Module II: **(10 Hours)**

Transportation problems:Finding an initial basic feasible solution by NorthwestCorner rule, Least Cost rule, Vogel's approximation method, Degeneracy, Optimalitytest, MODI method, Stepping stone method. **Assignment problems:** Hungarian method for solution of Assignment problems. Integer Programming: Branch and Bound algorithm for solution of integer programming problems.

Module III: **(12 Hours)**

Non-linear programming: Introduction to non-linear programming. Unconstraintoptimization: Fibonacci and Golden Section Search method. Constrained optimization with equality constraint: Lagrange multiplier, Projected gradient method. Constrained optimization with inequality constraint: Kuhn-Tucker condition, Quadratic programming.

Module IV: **(6 Hours)**

Queuing models: General characteristics, Markovian queuing model, M/M/1model, Limited queue capacity, multiple server, Finite sources, Queue discipline.

Books:

[1] Operations Research- Principle and Practice, A. Ravindran, D. T. Philips, J. Solberg, Second edition, Wiley India Pvt Ltd.
[2] Operation Research, Prabhakar Pai ,Oxford University Press
[3] Optimization for Engineering Design, Kalyanmoy Deb, PHI Learning Pvt Ltd.
[2] Operations Research, H.A.Taha, A.M.Natarajan, P.Balasubramanie, A.Tamilarasi, Pearson Education, Eighth Edition.
[5] Engineering Optimization, S S Rao, New Age International Pvt Ltd, 2003.
[6] Linear and Non-linear Optimization, **S**tephen G. Nash, A. Sofer, McGraw Hill, 2nd Edition.
[7] Engineering Optimization, A.Ravindran, K.M.Ragsdell, G.V.Reklaitis, Wiley India Pvt. Ltd, Second edition.
[3] Operations Research, F.S.Hiller, G.J.Lieberman, Tata McGraw Hill, Eighth Edition, 2005.
[9] Operations Research, P.K.Gupta, D.S.Hira, S.Chand and Company Ltd, 2014.

Digital Learning Resources:

Course Name:	Foundations of Optimization
Course Link:	https://nptel.ac.in/courses/111/104/111104071/
Course Instructor:	Dr. Joydeep Dutta, IIT Kanpur

6th Semester	RME6D001	Smart and Composite Materials	L-T-P 3-0-0	3 Credits

MODULE I (7 HOURS)

Introduction: definitions and classifications; natural composites; role of matrix and reinforcement; factors which determine properties; the benefits of composites.

Reinforcements and the reinforcement matrix interface: natural fibers; synthetic organic fibers – aramid, polyethylene; and synthetic inorganic fibers – glass, alumina, boron, carbon, silicon based fibers; particulate and whisker reinforcements, reinforcement-matrix interface – wettability, interfacial bonding, methods for measuring bond strength.

MODULE II (8 HOURS)

Metal matrix composites: Introduction, important metallic matrices; metal matrix composite processing: solid state processing – diffusion bonding, powder metallurgy; liquid state processing – melt stirring, compocasting (rheocasting), squeeze casting, liquid infiltration under gas pressure; deposition – spray co-deposition and other deposition techniques like CVD and PVD; in situ processes. Interface reactions. Properties of MMCs – physical properties; mechanical properties like elastic properties, room temperature strength and ductility, properties at elevated temperatures, fatigue resistance. Processing, structure of multifilamentary superconductors, properties of aluminium reinforced with silicon carbide particles

MODULE III (7 HOURS)

Ceramic matrix composites: Introduction; processing and structure of monolithic materials – technical ceramics, glass-ceramics. Processing of ceramics: conventional mixing and pressing – cold pressing and sintering, hot pressing, reaction bonding processes, techniques involving slurries, liquid state processing – matrix transfer moulding, liquid infiltration, sol-gel processing, vapour deposition techniques like CVD, CVI, liquid phase sintering, lanxide process and in situ processes. Processing, properties and applications of alumina matrix composites - SiC whisker reinforced, zirconia toughened alumina; Glass-ceramic matrix composites; Carbon-carbon composites - porous carbon-carbon composites, dense carbon-carbon composites.

MODULE IV (6 HOURS)

Polymer matrix composites: Introduction; polymer matrices – thermosetting, thermoplastic, rubbers. Processing of PMCs: Hand methods – hand lay-up, spray-up methods; Moulding methods – matched die moulding, bag moulding processes (autoclave moulding), resin transfer moulding, pultrusion; Filament winding; Injection moulding. Processing, properties and applications of fibre-reinforced epoxies, PEEK matrix composites, rubber matrix composites. Damping characteristics. Environmental effects in polymer matrix composites. Recycling of PMCs.

MODULE V (8 HOURS)

Sandwich structures, foam core type arrangements; Honey comb structures. Micromechanics of unidirectional composites: micromechanics models for stiffness – longitudinal stiffness, transverse stiffness, shear modulus, poisson's ratio. Micromechanics models for strength – longitudinal tensile strength, longitudinal compressive strength, transverse tensile strength, transverse compressive strength, inplane shear failure, thermal and moisture effects. Short fibre composites: reasons for using short fibre composites, fibre length, fibre orientation, stress and strain distribution at fibres, critical fibre length and average fibre stress, stiffness and strength: stiffness of aligned systems, non-aligned systems and variable fibre orientation, strength of aligned systems, 2-D composites, variable fibre orientation.

Books:

[1] Composite Materials: Engineering and Science, by Matthews and Rawlings, CRC Press.

[2] An Introduction to composite material, by D.Hull and T.W. Clyne, Cambridge University press.

[3] Metal Matrix Composites, Thermomechanical Behaviour by M.Taya, and R.J.Arsenault, Pergamon Press, Oxford.

[4] Fundamentals of Metal Matrix Composites by S.Suresh, A.Martensen, and A.Needleman, Butterworth, Heinemann

[5] Mechanics of composite materials, R. M. Jones, Mc Graw Hill Book Co.

[6] Mechanics of composite materials and structures, M Mukhopadhay, Universities Press.

[7] Fiber-Reinforced composite materials, Manufacturing & Design, P. K. Mallick, Marcel Dekken, Inc. New York & Basel.
[8] F.L. Matthews and R.D. Rawlings, Composite Materials: Engineering and Science, Chapman Hall, London, 1994.
[9] Weinheim, Structure and Properties of Composites, Materials ScienceTechnology, Vol. 13, VCH, Germany, 1993.

Digital learning Resources:

CourseName:	Introduction to Composites
CourseLink:	https://nptel.ac.in/courses/112/104/112104229/
CourseInstructor:	Dr Nachiketa Tiwari, IITKanpur

Course Name:	Processing of nonmetals
Course Link:	https://nptel.ac.in/courses/112/107/112107086/
Course Instructor:	Dr Indradeep Singh, IIT Roorkee

6th Semester	RME6D002	Compressible Flow and Gas Dynamics	L-T-P 3-0-0	3 Credits

Module I: (9 hours)
Fundamentals of Fluid dynamics and Thermodynamics: continuity equation, Momentum equation, Energy equation of incompressible flow Introduction to compressible flow: Introduction, Isentropic flow in a stream tube, speed of sound, Mach waves; One dimensional Isentropic Flow: Governing equations, stagnation conditions, critical conditions, maximum discharge velocity, isentropic relations

Module II: (9 hours)
Normal Shock Waves: Shock waves, stationary normal shock waves, normal shock wave relations in terms of Mach number; Oblique Shock Waves: Oblique shock wave relations, reflection of oblique shock waves, interaction of oblique shock waves, conical shock waves; Expansion Waves: Prandtl-Meyer flow, reflection and interaction of expansion waves, flow over bodies involving shock and expansion waves

Module III: (9 hours)
Variable Area Flow: Equations for variable area flow, operating characteristics of nozzles, convergent-divergent supersonic diffusers Adiabatic Flow in a Duct with Friction: Flow in a constant area duct, friction factor variations, the Fanno line; Flow with Heat addition or removal: One-dimensional flow in a constant area duct neglecting viscosity, variable area flow with heat addition, one-dimensional constant area flow with both heat exchanger and friction

Module IV: (9 hours)
Generalized Quasi-One-Dimensional Flow: Governing equations and influence coefficients, solution procedure for generalized flow with and without sonic point; Two-Dimensional Compressible Flow: Governing equations, vorticity considerations, the velocity potential, linearized solutions, linearized subsonic flow, linearized supersonic flow, method of characteristics.

Books

1. P. H. Oosthuizen and W. E. Carscallen. Compressible Fluid Flow. NY, McGraw-Hill, 1997.
2. H. W. Liepmann, and A. Roshko, Elements of Gas Dynamics, Dover Pub, 2001.
3. A. H. Shapiro, Compressible Fluid Flow 1 and 2. Hoboken NJ: John Wiley.
4. M. A. Saad, Compressible Fluid Flow. 2nd ed. Upper Saddle River, NJ: Prentice-Hall, 1993.
5. F. M. White, Viscous Fluid Flow. 2nd ed. New York: McGraw-Hill, 1991.

Course Name:	Gasdynamics: Fundamentals and Applications
Course Link:	https://onlinecourses.nptel.ac.in/noc21_ae03/preview
Course Instructor:	Prof. Srisha Rao M V, IISc Banglore

6^{th} Semester	RME6D003	Computer Integrated Manufacturing and FMS	L-T-P 3-0-0	3 Credits

MODULE – I (12 HOURS)

Fundamentals of Manufacturing and Automation: Production systems, automation principles and its strategies; Manufacturing industries; Types of production function in manufacturing;Automation principles and strategies, elements of automated system, automation functions and
level of automation; product/production relationship, Production concept and mathematicalmodels for production rate, capacity, utilization and availability; Cost-benefit analysis.Computer Integrated Manufacturing: Basics of product design, CAD/CAM, Concurrent engineering, CAPP and CIM.

MODULE – II (12 HOURS)

Industrial Robotics: Robot anatomy, control systems, end effectors, sensors and actuators; fundamentals of NC technology, CNC, DNC, NC part programming; Robotic programming, Robotic languages, work cell control, Robot cleft design, types of robot application, Processing operations, Programmable Logic controllers: Parts of PLC, Operation and application of PLC, Fundamentals of Net workings; Material Handling and automated storage and retrieval systems, automatic data capture, identification methods, bar code and other technologies.

MODULE – III (12 HOURS)

Introduction to manufacturing systems: Group Technology and cellular manufacturing, Partfamilies, Part classification and coding, Production flow analysis, Machine cell design, Applications and Benefits of Group Technology. Flexible Manufacturing system: Basics of FMS, components of FMS, FMS planning and implementation, flexibility, quantitative analysis of flexibility, application and benefits of FMS. Computer Aided Quality Control: objectives of CAQC, QC and CIM, CMM and Flexible Inspection systems.

Books :

1. Automation, Production Systems and Computer Integrated Manufacturing: M.P. Groover, Pearson Publication.
2. Automation, Production systems & Computer Integrated Manufacturing, M.P Groover, PHI.
3. CAD/CAM/CIM, P.Radhakrishnan, S.Subramanyam and V.Raju, New Age International
4. Flexible Manufacturing Systems in Practice, J Talavage and R.G. Hannam, Marcell Decker
5. CAD/CAM Theory and Practice, Zeid and Subramanian, TMH Publication
6. CAD/CAM Theory and Concepts, K. Sareen and C. Grewal, S Chand publication
7. Computer Aided Design and Manufacturing, L. Narayan, M. Rao and S. Sarkar, PHI.
8. Principles of Computer Integrated Manufacturing, S.K.Vajpayee, PHI
9. Computer Integrated Manufacturing, J.A.Rehg and H.W.Kraebber, Prentice Hall

Course Name: Computer Integrated Manufacturing
Course Link: https://onlinecourses.nptel.ac.in/noc21_me65/preview
Course Instructor: Prof. J Ramkumar, Prof Amandeep Singh, IIT Kanpur

6^{th} Semester		Artificial Intelligence and Machine Learning	L-T-P 3-0-0	3 Credits

Module-I: **(12 hours)**

INTRODUCTION –The Foundations of Artificial Intelligence; - INTELLIGENT AGENTS – Agents and Environments, Good Behaviour: The Concept of Rationality, the Nature of Environments, the Structure of Agents, SOLVING PROBLEMS BY SEARCH – Problem-Solving Agents, Formulating problems, Searching for Solutions, Uninformed Search Strategies, Breadth-first search, Depth-first search, Searching with Partial Information, Informed (Heuristic) Search Strategies, Greedy best-first search, A* Search, CSP, Means-End-Analysis.

Module-II: (12 hours)

ADVERSARIAL SEARCH – Games, The Mini-Max algorithm, optimal decisions in multiplayer games, Alpha-Beta Pruning, Evaluation functions, Cutting off search, LOGICAL AGENTS – Knowledge-Based agents, Logic, Propositional Logic, Reasoning Patterns in Propositional Logic, Resolution, Forward and Backward chaining - FIRST ORDER LOGIC – Syntax and Semantics of First-Order Logic, Using First-Order Logic , Knowledge Engineering in First-Order Logic - INFERENCE IN FIRST ORDER LOGIC – Propositional vs. First-Order Inference, Unification and Lifting, Forward Chaining, Backward Chaining, Resolution

Module-III: **(6 hours)**

UNCERTAINTY – Acting under Uncertainty, Basic Probability Notation, The Axioms of Probability, Inference Using Full Joint Distributions, Independence, Bayes' Rule and its Use, PROBABILISTIC REASONING – Representing Knowledge in an Uncertain Domain, The Semantics of Bayesian Networks, Efficient Representation of Conditional Distribution, Exact Inference in Bayesian Networks, Approximate Inference in Bayesian Networks

Module-IV: **(10 hours)**

LEARNING METHODS – Statistical Learning, Learning with Complete Data, Learning with Hidden Variables, Rote Learning, Learning by Taking Advice, Learning in Problem-solving, learningfrom Examples: Induction, Explanation-based Learning, Discovery, Analogy, FormalLearning Theory, Neural Net Learning and Genetic Learning. Expert Systems: Representingand Using Domain Knowledge, Expert System Shells, Explanation, Knowledge Acquisition.

Books:

[1] Elaine Rich, Kevin Knight, & Shivashankar B Nair, Artificial Intelligence, McGraw Hill,3rd ed.,2009

[2] Stuart Russell, Peter Norvig, *Artificial Intelligence -A Modern Approach*, 2/e, Pearson, 2003.

[3] Nils J Nilsson, *Artificial Intelligence: A New Synthesis*, Morgan Kaufmann Publications,2000

[4] Introduction to Artificial Intelligence & Expert Systems, Dan W Patterson, PHI.,2010

[5] S Kaushik, Artificial Intelligence, Cengage Learning, 1st ed.2011

Digital Learning Resources:

Course Name:	Artificial Intelligence Search Methods For Problem Solving
Course Link:	https://swayam.gov.in/nd1_noc20_cs81/preview
Course Instructor:	Prof. D. Khemani, IIT Madras

Course Name:	Fundamentals of Artificial Intelligence
Course Link:	https://swayam.gov.in/nd1_noc20_me88/preview
Course Instructor:	Prof. S. M. Hazarika, IIT Guwahati
Course Name:	Introduction to Machine Learning
Course Link:	https://nptel.ac.in/courses/106/105/106105152
Course Instructor:	Prof. S. Sarkar, IIT Kharagpur
Course Name:	Machine Learning
Course Link:	https://nptel.ac.in/courses/106/106/106106202
Course Instructor:	Prof. Carl Gustaf Jansson, IIT Madras

6th Semester		Electrical Energy Conservation and Auditing	L-T-P 3-0-0	3 Credits

MODULE – I **(12HOURS)**

Electrical energy conservation: Energy economics- discount rate, payback period, internal rate of return, net present value, and life cycle cost. Energy generation, energy distribution, energy usage by processes, technical and economic evaluation, understanding energy costs, classification of energy conservation measures, plant energy performance, benchmarking and energy performance, matching energy usage to requirement, maximizing energy system efficiency, optimizing the input energy requirements, fuel and energy substitution, and energy balancing.

EB billing- HT and LT supply, transformers, electric motors- motor efficiency computation, energy efficient motors, pumps, fans, blowers, compressed air systems, refrigeration and air conditioning systems, cooling towers, electric heaters (space and liquid), DG-sets, illuminating devices, power factor improvement, and harmonics.

MODULE – II **(08 HOURS)**

Electrical energy audit: Energy consumption pattern and scenario of any region; Energy auditing: Need, types, methodology and approaches; Preliminary energy audit methodology (initial site visit and preparation required for detailed auditing, detailed energy audit activities, information and data collection, process flow diagram and process steps); Procedure and techniques: Data gathering, evaluation of saving opportunities, and energy audit reporting; and Energy audit instruments.

MODULE – III **(15 HOURS)**

Illumination: Illumination, luminous flux, lumen, luminous intensity, candela power, brightness, glare, types of lighting (incandescent, CFL, and LED), requirements of lux for various purposes, determine the method of lighting, select the lighting equipments, and calculate the lighting parameters.

Books :

1. Callaghn, P. W." Design and Management for Energy Conservation", Pergamon Press, Oxford, 1981.
2. Dryden. I. G. C.," The Efficient Use of Energy", Butterworths, London, 1982.
3. Energy Economics -A. V. Desai (Wiley Eastern).
4. Handbook of Energy Efficiency - CRC Press
5. Energy Technology, OP Gupta, Khanna Book Publishing
6. Handbook of Energy Audits Albert Thumann, William J. Younger, Terry Niehus, 2009.
7. Handbook on Energy Audit and Environment Management, Y P Abbi and Shashank Jain, TERI, 2006.

6^{th} Semester		Control System	L-T-P 3-0-0	3 Credits

Module I: **(5 hours)**

Industrial Control examples. Mathematical models of physical systems. Control hardware and their models. Transfer function models of linear time-invariant systems. Feedback Control: Open-Loop and Closed-loop systems. Benefits of NegativeFeedback. Block diagram algebra. Signal Flow Graph and Mason'sGain formula.

Module II: **(10 hours)**

Standard test signals. Time response of first and second order systems for standard test inputs. Application of initial and final value theorem. Design specifications for second-ordersystems based on the time-response. Concept of Stability. Routh-Hurwitz Criteria. Relative Stability analysis. Root-Locus technique. Construction of Root-loci.

Module III: **(7 hours)**

Relationship between time and frequency response, Polar plots, Bode plots. Nyquist stabilitycriterion. Relative stability using Nyquist stability criterion – gain and phase margins. Closed-loop frequency response: Constant M Circle, Constant N Circle, Nichols Chart.

Module IV: **(10 hours)**

Stability, steady-state accuracy, transient accuracy, disturbance rejection, insensitivity and robustness of control systems. Root-loci method of feedback controller design. Design specifications in frequency-domain. Frequency-domain methods of design. Application of Proportional, Integral and Derivative Controllers, Tuning of PID controllers, Lead and Lag and Lag-Lead compensator design.

Module V: **(10 hours)**

Concepts of state variables. State space model. Diagonalization of State Matrix. Solution of state equations. Eigenvalues and Stability Analysis. Concept of controllability and observability. Pole-placement by state feedback. Discrete-time systems. Difference Equations. State-space models of linear discrete-time systems. Stability of linear discrete-time systems.

Books:

[1] I. J. Nagrath and M. Gopal, "Control Systems Engineering", New Age International, 2009.
[2] K. Ogata, "Modern Control Engineering", Prentice Hall, 1991
[3] M. Gopal, "Control Systems: Principles and Design", McGraw Hill Education, 1997.
[4] B. C. Kuo, "Automatic Control System", Prentice Hall, 1995.

Digital Learning Resources:

Course Name: Control System Engineering
Course Link: https://nptel.ac.in/courses/108/102/108102043/
Course Instructor: Prof. M Gopal, IIT Delhi

6th Semester	RIK6F001	Essence of Indian Knowledge Tradition - I	L-T-P 3-0-0	0 Credits

Course Objective:

The course aims at imparting basic principles of thought process, reasoning and inferencing. Sustainability is at the core of Indian Traditional Knowledge Systems connecting society and nature.Holistic life style of Yogic-science and wisdom capsules in Sanskrit literature are also important in modern society with rapid technological advancements and societal disruptions. The course focuses on introduction to Indian Knowledge System, Indian perspective of modern scientific world-view and basic principles of Yoga and holistic health care system.

Course Outcomes:

- Ability to understand, connect up and explain basics of Indian Traditional knowledge modern scientific perspective.

Course Content:

- Basic Structure of Indian Knowledge System (i) वेद, (ii) उपवेद (आयुर्वेद, धनुर्वेद, गन्धर्वेद, स्थापत्य आदि) (iii) वेदांग (शिक्षा, कल्प, निरुत, व्याकरण, ज्योतिष छंद), (iv) उपाङ्ग (धर्म शास्त्र, मीमांसा, पुराण, तर्कशास्त्र)
- Modern Science and Indian Knowledge System
- Yoga and Holistic Health care
- Case Studies.

Books:

1. V. Sivaramakrishna (Ed.), Cultural Heritage of India-Course Material, Bharatiya Vidya Bhavan, Mumbai, 5th Edition, 2014

2. Swami Jitatmanand, Modern Physics and Vedant, Bharatiya Vidya Bhavan

3. Fritzof Capra, Tao of Physics

4. Fritzof Capra, The wave of Life

5. V N Jha (Eng. Trans,), Tarkasangraha of Annam Bhatta, Inernational Chinmay Foundation, Velliarnad, Amaku,am

6. Yoga Sutra of Patanjali, Ramakrishna Mission, Kolkatta

7. GN Jha (Eng. Trans.) Ed. R N Jha, Yoga-darshanam with Vyasa Bhashya, VidyanidhiPrakasham, Delhi, 2016

8. RN Jha, Science of Consciousness Psychotherapy and Yoga Practices, VidyanidhiPrakasham, Delhi, 2016 9. P R Sharma (English translation), ShodashangHridayam

5th Semester	RME5C201	Design of Machine Elements Lab	L-T-P 0-0-3	2 Credits

LIST OF EXPERIMENTS:

1. Design of any one working model related to Design of machine elements i.e., Module I and II.
2. Design of any one working model related to Design of machine elements i.e., Module III and IV.
3. Design & drawing of Riveted joint
4. Design and drawing of Cotter joint
5. Design and drawing of Knuckle joint
6. Design of shafts subjected to combined loading
7. Design and drawing of Flange coupling
8. Design of spring
9. Design of bearing

Total no. of Drawing: 6
3 in drawing sheets
3 in AutoCad/Pro-E/CATIA/ANSYS

5th Semester	RME5C202	Machining Science and Technology Lab	L-T-P 0-0-3	2 Credits

LIST OF EXPERIMENTS:

(Minimum 08 Experiments/Studies)

1. Job on lathe with tapper turning, thread cutting, knurling and groove cutting (3 experiments).
2. Gear cutting (with index head) on milling machine
3. Working with shaper, Planner and slotting machine.
4. Working with surface and cylindrical grinding.
5. Determination of cutting force using Lathe tool dynamometer.
6. Determination of cutting force in drilling using drill tool dynamometer.
7. Study of Non-traditional machining processes.(USM, AJM, EDM, ECM)
8. Study of CNC Lathe and demonstration of making job in CNC lathe.
9. Study of CNC Milling machine and demonstration of making job in CNC Milling machine

6th Semester		**Future-ready Contributor Program Laboratory**	**L-T-P 0-0-3**	**2 Credits**

Outcomes: The Future-ready Contributor Program aims to accomplish the following outcomes in the lives of students–

- Improve the employability of students by giving them the right work ethic and thinking that employers are looking for.
- Build their confidence with which they can go into any job and contribute meaningfully.
- Improve their ability to engage better in the workplace and to be able to handle the challenges that come up there.
- Build their career-worthiness and help them develop into future-ready contributors with ability to navigate a career in a volatile, changing world.
- Widen their choices of career and success, so that they are able to open up more opportunities for themselves and take up unconventional career pathways.
- Enable them recognize how they as technical professionals, can participate and make a positive contribution to their communities and to their state.

The Program content is also designed to expose students to real-world workplace scenarios and sensitize them to some of the challenges faced in society around them, especially in the local communities around them and in their own state of Odisha.

The Contributor Program syllabus has been evolved and fine-tuned over several years, to –

a) address the changing need and contemporary challenges being faced by industry and what employers of today are looking for in the people they hire;
b) working extensively with universities and students and an appreciation of their challenges and concerns;
c) guided by the higher ideas and principles of practical Vedanta in work.

Sr. No.		Content	Total Hrs
1	**Part 1 : Developing self-efficacy and basic inner strength**	**Who is a Future-ready Contributor?** *In this topic, students understand the new work environment, expectations from future workforce, and importance of being a future-ready contributor. This enables students to transform their expectation of themselves in work*	3 hrs lab sessions (discovery-based facilitator led)
2		**Self-esteem & Growth Identity** *In this topic, students learn how to develop a deeper and more resilient self esteem and how to adopt a growth identity/ mindset, that is more appropriate to the demands of the future workplace.*	Same as above
3		**Become a Creator of one's destiny** *In a "victim stance", we see the career environment as full of difficulties and hurdles. We feel powerless or blame our circumstances for not having many opportunities. This makes us fearful of uncertainty and makes us settle for jobs where we remain mediocre. In this topic, students discover the "creator of destiny stance" to challenges and situations. This stance helps them take ownership & responsibility to shape destiny, build a new future & find answers to challenges; and stop being complainers.*	Same as above
4	**Part 2 : Building ability to make more effective career choices**	**Achieving Sustainable Success** *In this topic, students discover how to achieve sustainable or lasting success, by making themselves success-worthy. Where their focus shifts to building one's "engine of success" rather than being on chasing the "fruits of success". This is important, because over a lifetime of work, all people go through ups and downs – where the fruits are not in their control. People who are focused on the fruits of success, fall prey to disappointment, loss in motivation, quitting too early, trying to find shortcuts – when fruits don't come. Whereas people focused on building their engine of success continue to contribute steadily, irrespective of whether fruits come or not.*	Same as above

		This helps them make better choices in life, that leads to steady success & long-term career fulfillment in an uncertain world.	
5		**Career Development Pathways for a changing world** *In this topic, students explore a range of diverse "career development models" and the possibilities for contribution each opens up to them. This helps them open up hidden opportunities that such an environment offers. And free themselves from a herd mentality when making career choices.*	Same as above
6		**Make an impact in every part of one's life** *In this topic, students learn how to expand the contribution possible in any role they have. This helps them take charge of own career growth & discover their power to contribute in any role or job.*	Same as above
7	**Part 3 : Building ability to become solution and value creating individuals in the world**	**Think Solutions** *The market environment in which organizations are operating, is becoming increasingly dynamic and uncertain. So, employers are increasingly seeking out people who can innovate and figure out solutions in the face of any challenge (unlike in the past when it was the people who were most efficient and productive, who were valued by organizations). At the heart of innovation lies this way of thinking of "finding solutions" rather than "seeing problems or roadblocks". Students learn how to build this way of thinking, in this topic.*	Same as above
8		**Value Thinking** *Companies are also looking for employees who do not just work hard, or work efficiently or productively - but those who will make a valuable difference to the fortunes of the company. This difference may come from innovation, but it may also come from focusing on the right things and identifying what really matters – both to the company and to the customers. In this topic, students learn how to build this capability.*	Same as above

9		**Engaging Deeply** *The environment we live in is becoming increasingly complex because more and more things are getting interconnected, new fields are emerging, technologies are rapidly changing, capabilities and knowledge one is trained in will become fast obsolete. In such a scenario, the student's ability to quickly understand and master what is going on, dive deep, get involved in any area, rapidly learn new capabilities that a job demands, is important. In this topic, students learn how to engage deeply. Learning how to dive deep, to quickly understand what is going on, get involved in any area, and rapidly learn.*	Same as above
10	**Part 4 : Building ability to work collaboratively and as good citizens of organizations and the country**	**Enlightened self-interest & collaboration at work** *The changing nature of work in organizations and in the global environment, is increasingly demanding that people work more collaboratively towards shared goals and more sustainable goals. A key to working successfully when multiple stakeholders are involved, is "thinking in enlightened self-interest". In this topic, students learn how to widen their thinking from "narrow self-interest" to "enlightened self-interest" to work more effectively in teams & collaboratives.*	Same as above
11		**Human-centered thinking & Empathy** *In this topic, students learn to recognize & respond to human needs and challenges – the way of thinking at the heart of user-centric designs & customer-centricity.*	Same as above
12		**Trust Conduct** *The biggest currency in a sustainable career is "trust" i.e. being trusted by team members, bosses, customers. When we are trusted, people listen to us, they are willing to give us the chance to grow, give us the space to make mistakes, and work seamlessly with each other without always having to "prove ourselves". In this topic, students learn how to build trust with people they engage with.*	Same as above
Contribution Project Lab Sessions		*3 Contribution projects that help them apply contributor thinking. After students complete their project work (beyond the classroom), each project ends with this 3 hr lab session where they build their project output and*	9 hrs (3 hr lab sessions for each of 3 projects)

	present.	
Project work	*The above Contribution Projects require research, and may need field work beyond the classroom that students are expected to do.*	Beyond classroom

Lab Sessions:

- Students will have to attend twelve discovery-based lab sessions to build new models of thinking & capacities (3 hrs per module)
- They will work closely with their peers to discuss and understand these new models of thinking.
- Their learning will be facilitated by trained college faculty.

Contribution Projects

- Three contribution projects that help them apply contributor thinking
- These will require research and also may need field work

Each ends with a 3 hr lab session where they build their project output

BIJUPATNAIKUNIVERSITY OF TECHNOLOGY, ODISHA

ROURKELA

Curriculum and Syllabus

B. Tech (*MechanicalEngineering*)from the Admission Batch 2018-19

Semester (7^{th})

Seventh Semester							
Theory							
Sl No	**Category**	**Course Code**	**Course Title**	**L-T-P**	**Credit**	**University Marks**	**Internal Evaluation**
1	HS	RED7E001	Entrepreneurship Development	3-0-0	3	100	50
2	PE	RME7D001	Power Plant Engineering	3-0-0	3	100	50
		RME7D002	Product Design and Production Tooling (PDPT)				
		RME7D003	Design of Machine Components				
3	PE	RME7D004	Mechanical Vibration	3-0-0	3	100	50
		RME7D005	Refrigeration and Air Conditioning				
		RME7D006	Micro and Nano Machining				
4	OE	REI6D001	Micro Electronic Mechanical Systems	3-0-0	3	100	50
		REC5D006	Digital VLSI Design				
		REC7D002	Embedded Systems				
5	OE	REV5D004	Disaster Management	3-0-0	3	100	50
		RIP7E002	Intellectual Property Right				
		RGT6A003	Green Technology				
6	OE	RIT7D001	Internet of Things	3-0-0	3	100	50
		RIS7B001	Industrial Safety Engineering				
		RCS7D007	Soft Computing				
7	MC*	RIK7F001	Essence of Indian Knowledge Tradition - II	3-0-0	0		100 (Pass Mark is 37)
Total Credit (Theory)					**18**		
Total Marks						**600**	**300**
Practical							
1	PSI	RMP7H201	Minor Project	0-0-6	3		200
2	PSI	RSM7H202	Seminar - II	0-0-3	1		100
3	PSI	RCV7H203	Comprehensive Viva	0-0-3	1		100
Total Credit (Practical)					**5**		
Total Semester Credit					**23**		
Total Marks							**400**

***Mandatory Non-Credit Courses (MC) result will be reflected with Pass (P) / Fail (F) grade. Thus, the grade obtained will not be affecting the grade point average. However, it shall appear on the grade sheet as per AICTE rule.**

7th Semester	RED7E001	Entrepreneurship Development	L-T-P 3-0-0	3 Credits

Module I: **(10 hours)**

Entrepreneurship: Concept of entrepreneurship and intrapreneurship, Types of Entrepreneurs, Nature and Importance, Entrepreneurial Traits and Skills, Entrepreneurial Motivation and Achievement, Entrepreneurial Personality

Module II: **(8 hours)**

Entrepreneurial Environment, Identification of Opportunities, Converting Business Opportunities into reality. Start-ups and business incubation, Setting up a Small Enterprise. Issues relating to location, Environmental Problems and Environmental pollution Act, Industrial Policies and Regulations

Module III: **(10 hours)**

Need to know about Accounting, Working capital Management, Marketing Management, Human Resources Management, and Labour Laws. Organizational support services - Central and State Government, Incentives and Subsidies.

Module IV: **(12 hours)**

Sickness of Small-Scale Industries, Causes and symptoms of sickness, cures of sickness, Role of Banks and Governments in reviving industries.

Books:

[1] Entrepreneurship Development and Management, Vasant Desai, HPH
[2] Entrepreneurship Management, Bholanath Dutta, Excel Books
[3] Entrepreneurial Development, Sangeeta Sharma, PHI
[4] Entrepreneurship, Rajeev Roy, Oxford University Press

Digital Learning Resources:

Course Name: Entrepreneurship
Course Link: https://nptel.ac.in/courses/110/106/110106141/
Course Instructor: Prof. C Bhaktavatsala Rao, IIT Roorkee

Course Name: Entrepreneurship Essentials
Course Link: https://nptel.ac.in/courses/127/105/127105007/
Course Instructor: Prof. Manoj Kumar Mondal, IIT Kharagpur

Module I: **(10 hours)**

1. INTRODUCTION

Different sources (Conventional and non-conventional) of energy and the principle of power generation only, Types of power plant and site selection, overall view of a steam power plant.

2. STEAM GENERATOR

Fossil fuel steam generators, classification, circulation in water tube boilers, Modern high pressure water tube boilers (both sub critical and super critical), Boiler mounting and accessories, Combustion equipment: air supply systems (Natural and Mechanical Draught Systems). Pulverized coal burning systems and Basics of Fluidized bed combustion, Feed water treatment (Necessity & general consideration only). Boiler performance calculations.

Module II: **(8 hours)**

3. FLOW THROUGH NOZZLES

Types of nozzles and their area of application & related calculation, critical pressure & chocked flow, super saturated flow. Effect of friction and nozzle efficiency

4. STEAM TURBINES

Turbine types, Variation of Pressure and Velocity in different types of turbines, Simple impulse Turbines, Flow through turbine blades and velocity diagram, Pressure - compounded impulse turbines and Velocity compounded impulse turbines. Turbine power and related calculations.

Module III: **(10 hours)**

5. REACTION TURBINES

Reaction turbines Flow through blades and velocity diagram, degrees of reaction, Parsons turbine, power and related calculations, Blade height calculations, Losses in steam turbines, Reheat factor & condition line, Governing of turbines.

6. STEAM CONDENSER & CIRCULATING WATER SYSTEMS

Types, Surface condenser, Performance calculation, Air removal methods, Vacuum & vacuum efficiency. Cooling towers. (types, principle of operation and performance)

Module IV: **(8 hours)**

7. NUCLEAR POWER PLANT

Introduction, Nuclear fuels, Nuclear fission, Reactor components, & materials and classification,, Boiling Water Reactor (BWR), Pressurized water Reactor (PWR),CANDU Reactor, Gas cooled Reactors, Liquid metal fast breeder Reactor. Heavy water Reactors .Waste disposal and Safety of Nuclear power plant

8. ECONOMICS OF POWER PLANT

Basic definitions, cost of electrical energy (Fixed cost and operating cost), Types of tariff, Types of loads (typical load curves), Economic Load sharing

Books:

1. Power plant Engineering ; - By P.K. Nag (2nd edition) TMH
2. Power Plant Engineering by Arora and Domkundwar, Dhanpat Rai publications
3. Power Plant Engineering by Yadav
4. Power Plant Engineering by Rajput
5. Power plant Technology : By E.I. Wakil TMH
6. Power Plant Engineering by C.Elanchezhian, Sarvanakumar, Vijayramnath, IK International Publishing House Pvt Ltd.

7th Semester	RME7D002	Production Design and Power Plant Engineering Production Tooling	L-T-P 3-0-0	3 Credits

Module I: **(12 Hours)**

Product Design-Product design considerations, product planning, product development, value analysis, product specification. Role of computer in product design.
Process Planning – selection of processes, machines and tools. Design of sequence of operations, Time & cost estimation

Module II: **(12 Hours)**

Forging design- allowances, die design for drop forging, design of flash and gutter, upset forging die design.
Sheet metal working- Design consideration for shearing, blanking piercing, deep drawing operation, Die design for sheet metal operations, progressive and compound die, strippers, stops, strip layout.

Module III: **(12 Hours)**

Design of jigs and fixtures, principle of location and clamping, clamping methods, locating methods,Drill Jig bushing, Indexing type drilling Jig.
Design of single point cutting tool, broach and form tool. Tooling design for turret lathe andautomats. Design of limit gauges.

Books:

[1] Product Design & Manufacturing, A K Chitale, R C Gupta, Eastern Economy Edition,PHI.
[2] Product Design & Development, Karl T Ulrich, Steven D Eppinger, Anita Goyal, Mc-Graw Hill.
[3] A Textbook of Production Engineering, P.C. Sharma, S. Chand & Co
[4] Fundamentals of Tool Engineering design, S.K. Basu, S.N. Mukherjee, R. Mishra, Oxford &IBH Publishing Co.
[5] Technology of Machine Tools, Krar, Gill, Smid, Tata Mc Graw Hill
[6] Jigs & Fixture Design, Edwrd G Hoffman, Cengae Learning.

7th Semester	RME7D003	Design of Machine Components	L-T-P 3-0-0	3 Credits

Module-I: **(10 hours)**

Design of Pressure vessels: Thin pressure vessels: cylindrical and spherical vessels,Design of end Closures, Thick cylindrical shells.

Design of Lever: Classification, Design of levers, Cranked lever, Lever of safety - valve.

Module-II: **(10 hours)**

Design of belt drive and power screw: Design of belt drive and pulley, Power screwdesign with square thread such as screw jack.

Design of clutch and brake: Friction clutch, Cone clutch and Centrifugal clutch, Blockbrake, Band brake, Internal expanding shoe brake.

Module-III: **(10 hours)**

Gears: Design of Spur, Helical, bevel and worm gears. **Flywheel:** Design of Flywheel.

Module-IV: **(12 hours)**

Design of I.C. Engine components: Design of Cylinder, Piston, Connecting Rod, CrankShaft.

Introduction to Finite Element Method: FEM fundamental concepts, Procedure of FEM,Finite Element Modeling of one-dimensional problems. Finite Element Analysis of 2-Dproblems: Shape function, Strain Displacement Relation, Element Characteristics Matrix.

Books:

[1] Design of Machine Elements, V.B. Bhandari, Tata McGraw Hill
[2] Design of Machine Elements by C. S. Sharma and K. Purohit, PHI
[3] Mechanical Engineering Design, J.E.Shigley, C.R.Mischke, R.G.Budynas and K.J.Nisbett, TMH
[4] Machine Design, P.Kanaiah, Scietech Publications
[5] Fundamentals of Machine Component Design by R.C.Juvinall and K.M.Marshek, John Wiley & Sons
[6] Machine Drawing by N.Sidheswar, McGraw-Hill
[7] Machine Design, P.C.Sharma and D.K.Agrawal, S.K.Kataria& Sons
[8] Machine Design, Pandya and Shah, Charotar Book Stall
[9] Machine Design, Robert L. Norton, Pearson Education Asia.

7th Semester	RME7D004	Mechanical Vibration	L-T-P 3-0-0	3 Credits

Design Hand Book:

1. P.S.G. Design Data Hand Book, PSG College of Tech Coimbature
2. Design Data Hand Book, K. Lingaiah, McGraw Hill, 2nd Ed. 2003.
3. Design Hand Book by S.M.Jalaluddin ; Anuradha Agencies Publications
4. Design Data Hand Book by K.Mahadevan and B.Reddy,CBS Publishers

Module I: **(12 Hours)**

INTRODUCTION & IMPORTANCE OF MECHANICAL VIBRATION:
Brief history of Mechanical Vibration, Types of Vibration, Simple Harmonic Motion (S.H.M.),Principle of superposition applied to S.H.M., Beats, Fourier Analysis, Concept of degree of freedomfor different vibrating systems.
UNDAMPED FREE VIBRATION OF SINGLE DEGREE FREEDOM SYSTEMS: Modeling of VibratingSystems, Evaluation of natural frequency – differential equation, Energy & Rayleigh's methods,Equivalent systems.
DAMPED FREE VIBRATION OF SINGLE DEGREE FREEDOM SYSTEMS: Different types of damping,Equivalent viscous damping, structural damping, Evaluation of damping using free and forcedVibration technique, Concept of critical damping and its importance, study of vibration response ofviscous damped systems for cases of under damping, critical damping and over damping,Logarithmic decrement.

Module II: **(12 Hours)**

FORCED VIBRATION OF SINGLE DEGREE FREEDOM SYSTEMS: Steady state solution with viscousdamping due to harmonic force, reciprocating and rotating unbalance mass, vibration isolation andtransmissibility due to harmonic force excitation and support motion. Vibration measuringinstruments – vibrometer and accelerometer. Whirling of shaft with single disc and without damping, Concept of critical speed and its effect on the rotating shaft.

UNDAMPED VIBRATION OF TWO DEGREE FREEDOM SYSTEMS: Free vibration of spring coupledand mass coupled systems, Longitudial, Torsional and transverse vibration of two degree freedomsystems, influence coefficient technique, Un-damped vibration Absorber.

Module III:

(12 Hours)

INTRODUCTION TO MULTI-DEGREE FREEDOM SYSTEMS: Normal mode vibration, Co-ordinate coupling-close coupled and far coupled systems, Orthogonality of mode shapes, Methods of matrix iteration, Holzer's method and Stodola method. Torsinal vibration of two, three and multi-rotor systems. Dunkerley's lower bound approximate method.

CONTINOUS SYSTEMS: Vibration of strings, longitudinal vibration of rods, torsional vibration of rods, transverse vibration of Euler-beams.

Books:

[1] Theory of vibration with Applications: W.T. Thomson and Marie Dillon Dahleh,

7th Semester	RME7D005	Refrigeration and Air conditioning	L-T-P 3-0-0	3 Credits

Pearson
Education 5th ed. 2007.
[2] Introductory Course on theory and Practice of Mechanical Vibrations. J.S. Rao & K. Gupta,
New Age International Publication, New Delhi, 2007.
[3] Mechanical Vibrations: S.S. Rao, Prarson Education Inc, 4th ed. 2003.

[4] Mechanical Vibrations: S. Graham Kelly, Schaum's outline series, Tata McGraw Hill, Special Indian ed., 2007
[5] Mechanical Vibrations: V.P. Singh, Dhanpat Rai & company Pvt. Ltd. 3rd ed., 2006
[6] Elements of vibration Analysis: Leonard Meirovitch, Tata McGraw Hill, Special Indian ed.,2007

Module-I: **(12 Hours)**

Air Refrigeration System : Introduction, Unit of refrigeration, Coefficient of performance,Reversed Carnot Cycle, Temperature limitations, maximum COP, Bell Coleman air cycle,Simple Air Cycle System for Air-craft with problems.
Vapour Compression System : Analysis of theoretical vapour compression cycle,Representation of cycle on T - S and p - h diagram, Simple saturation cycle, sub-cooled cycleand super-heated cycle, Effect of suction and discharge pressure on performance, Actualvapour compression cycle. Problem illustration and solution.
Multi-stage compression and Multi-evaporator systems : Different arrangements ofcompressors and inter-cooling, Multistage compression with inter-cooling, Multievaporatorsystem, Dual compression system. Simple problems

Module-II: **(12 Hours)**

Vapour Absorption System : Simple Ammonia - absorption system, Improved absorptionsystem, Analysis of vapour absorption system (Specifically of analyzing coloumn andrectifier), Electrolux / Three fluid system, Lithium-bromide-water vapour absorptionsystem, comparison of absorption system with vapour compression system. SimpleProblems and solution.

Thermoelectric Refrigeration: Basics and Principle. Defining the figure of Merit. (NoProblem)**Refrigerants:** Classification of refrigerants and its designations- Halocarbon (compounds,Hydrocarbons, Inorganic compounds, Azeotropes, Properties of refrigerants, comparison ofcommon refrigerants, uses of important refrigerants, Brines. Alternative refrigerants(Organic and inorganic compounds).

Module-III: **(12 Hours)**

Psychrometrics : Properties of air-vapour mixture, Law of water vapour-air mixture,Enthalpy of moisture, Psychrometric chart, simple heating and cooling, Humidification, Dehumidification,Mixture of air streams. Review question and discussions
Requirements of comfort air conditioning: Oxygen supply, Heat removal, moisture removal,air motion, purity of air, Thermodynamics of human body, comfort and comfort chart,effective temperature, factors governing optimum effective temperature
Air Conditioning System: Process in air conditioning : Summer air conditioning, Winter airconditioning and year round air conditioning, Cooling load calculations. Review questionand discussions.

7th Semester	RME7D006	Micro and Nano Machining	L-T-P 3-0-0	3 Credits

Books:

[1] Refrigeration and Air Conditioning by R.C. Arora , PHI Publication
[2] Refrigeration and Air conditioning by C.P. Arora, Tata McGraw Hill.
[3] Refrigeration and Air Conditioning by S.C. Arora and S. Domkundwar, Dhanpat Rai & Sons. (Chapters; 3,4,5,6,7,11,16,17,19,20)
[4] Refrigeration and Airconditioning Data book by Manohar Prasad
[5] Refrigeration and Air conditioning by P.L. Ballney, Khanna Publishers.
[6] Refrigeration and Air conditioning by Manohar Prasad, New Age international publishers

Module-I: **(12 hours)**

Introduction

Introduction, Basic elements of molecular dynamics modelling, Design and requirements forstate-of-the-art MD cutting process simulations, Capabilities of MD for nanoscale materialremoval process analysis, Advances and recent developments in material removal processsimulation, Summary.

Ductile Mode Cutting of Brittle Materials

The mechanism of ductile mode cutting of brittle materials, The chip formation in cutting ofbrittle materials, Machined surfaces in relation to chip formation mode

Diamond Tools in Micromachining

Diamond technology, Preparation of substrate, Modified HFCVD process, Nucleation and diamond growth, Deposition on complex substrates, Diamond micromachining.

Module-II: (8 hours)

Conventional Processes: Micro-turning, Micro-drilling and Micro-milling

Introduction, Micro-turning, Micro-drilling, Micro-milling, Product quality in micromachining

Micro-grinding and Ultra-precision Processes

Introduction, Micro and nanogrinding, Nanogrinding tools

Module-III: **(8 hours)**

Non-Conventional Processes: Laser Micromachining

Introduction, Fundamentals of lasers, Laser microfabrication, Laser nanofabrication.

Evaluation of Subsurface Damage in Nano and Micromachining

Destructive evaluation technologies, Non-destructive evaluation technologies

Module-IV: **(10 hours)**

Micro and Nano Finishing Processes

Need for Nano finishing, Magnetic abrasive Finishing, Magnetorheological Finish, ElasticEmission Finishing, Magnetic Float Polishing, Ion Beam finishing.

Micro Joining

6th Semester	REI6D001	Micro Electronics Mechanical Systems	L-T-P 3-0-0	3 Credits

Challenges, Micro Resistance welding, Ultrasonic welding, Micro TIG, Applications.

Applications of Nano and Micromachining in Industry

Typical machining methods, Applications in optical manufacturing, Semiconductor andelectronics related applications.

Books:

[1] J. Paulo Davim, Mark J. JacksonNano and Micromachining,John Wiley & Sons, 2013
[2] Mark. J. Jackson, Micro and Nano-manufacturing, Springer, 2006.
[3] Mark. J. Jackson, Micro-fabrication and Nano-manufacturing - Pulsed water drop micromachining CRC Press 2006.
[4] NitaigourPremchandMahalik, Micro-manufacturing and Nanotechnology, 2006.
[5] V.K.Jain, Micro-manufacturing Processes, CRC Press, 2012.
[6] Yi Qin, Micro-manufacturing Engineering and Technology, William Andrew, 2015

Module-I: **(12 hours)**

Introduction and Emergence of MEMS, Scaling issues, materials for MEMS, Thin film deposition, Photolithography, doping, wet and dry etching

Micromachining Techniques: Surface and Bulk micro machining, wafer bonding, surface micro machining and LIGA process, Silicon as material for micromachining, (Chapter 3 and Section 8.2 of Book 1, Chapter 2 of Book 2)

Module-II: **(12 hours)**

MEMS devices, Engineering Mechanics for Micro System Modeling and Design – static bending of thin plates, Mechanical vibrational analysis, Thermo mechanical analysis,fracture mechanics analysis, thin film mechanics, Mechanics of deformable bodies, Energy method, Estimation of stiffness and damping for different micro-structures, Modeling of electromechanical systems, Pull-in voltage, Theory and design: Micro Pressure Sensor, micro accelerometer – capacitive and piezoresistive, micro actuator.(Section 4.1 to 4.3 and 6.2.2 of Book 1, Section 3.4 of Book 2)

Module-III: **(12 hours)**

MEMS Applications: Mechanical sensors and actuators: Piezoresistive pressure sensors, MEMS capacitive accelerometer, OpticalGyroscopes: Micro-lens, Micro-mirror, Optical Switch Radiofrequency MEMS:Inductor, Varactor, Filter, Resonator.

Microfluidics: Capillary action, Micro pumping, Electro wetting, Lab-on-a-chip.

Electronic interfaces, design, simulation and layout of MEMS devices using CAD tools.(Section 10.1to 10.8 of Book 2)

Books:

[1] G.K. Ananthsuresh, K.J. Vinoy, S. Gopalakrishnan, K.N. Bhat and V.K. Atre: Micro and Smart Systems, Wiley India, New Delhi, 2010.
[2] N.P. Mahalik: MEMS, Tata McGraw-Hill, New Delhi, 2007.
[3] T. Hsu: MEMS and Microsystems: Design and Manufacture, Tata McGraw-Hill, New Delhi, 2002.

7th Semester	REC5D006	Digital VLSI Design	L-T-P 3-0-0	3 Credits

[4] Gabriel M. Rebeiz: RF MEMS Theory, design &Technology, Wiley India Education,2010.

Digital Learning Resources:

Course Name: MEMS and Microsystems
Course Link: https://nptel.ac.in/courses/117/105/117105082/

MODULE-I **(08Hours)**

Introduction: Historical Perspective, VLSI Design Methodologies, VLSI Design Flow, Design Hierarchy, Concept of Regularity, Modularity and Locality, VLSI Design Styles, Computer-Aided Design Technology.
Fabrication of MOSFETs: Introduction, Fabrication Processes Flow – Basic Concepts, The CMOS n-Well Process, Layout Design Rules, Stick Diagrams, Full Customs Mask Layout Design.
MOS Transistor: The Metal Oxide Semiconductor (MOS) Structure, The MOS System under External Bias, Structure and Operation of MOS Transistor (MOSFET), MOSFET Current-Voltage Characteristics, MOSFET Scaling and Small-Geometry Effects, MOSFET Capacitance.

MODULE-II
MOS Inverters – Static Characteristics: Introduction, Resistive-Load Inverters, Inverters with n-Type MOSFET Load, CMOS Inverter.
MOS Inverters – Switching Characteristics and Interconnect Effects: Introduction, Delay-Time Definitions, Calculation of Delay-Times, Inverter Design with Delay Constraints, Estimation of Interconnect Parasitics, Calculation of Interconnect Delay, Switching Power Dissipation of CMOSInverters.
Combinational MOS Logic Circuits: Introduction, MOS Logic Circuits with Depletion NMOS Loads, CMOS Logic Circuits, Complex Logic Circuits, CMOS Transmission Gates (Pass Gates).

MODULE-III
Sequential MOS Logic Circuits: Introduction, Behaviour of Bistable Elements, SR Latch Circuits, Clocked Latch and Flip-Flop Circuits, CMOS D-Latch and Edge Triggered Flip Flop.
Dynamic Logic Circuits: Introduction, Basic Principles of Pass Transistor Circuits, Voltage

Bootstrapping, Synchronous Dynamic Circuit Techniques, Dynamic CMOS Circuit Techniques, High Performance Dynamic CMOS Circuits.

MODULE-IV

Design for Testability: Introduction, Fault Types and Models, Ad Hoc Testable Design Techniques, Scan-Based Techniques, Built-In Self-Test (BIST) Techniques, Current Monitoring IDDQ Test.

MODULE-V

Semiconductor Memories: Introduction, Dynamic Random Access Memory (DRAM), Static Random Access Memory (SRAM), Non-volatile Memory, FlashMemory.

Books:

[1] *CMOS Digital Integrated Circuits: Analysis and Design*, Sung-Mo Kang and Yusuf Leblebici, Tata McGraw-Hill Publishing Company Limited, 3rdEdn, 2003.

[2] Principles of CMOS VLSI Design – a Systems Perspective, K. Eshraghian and N.H.E. Weste, Addison Wesley,2nd Edition, 1993.

[3] Digital Integrated Circuits– *A Design Perspective***,** Jan M. Rabaey,Anantha Chandrakasan, Borivoje Nikolic, PHI, 2nd Edn.

[4] Modern VLSI Design System – *on – Chip Design*, Wayne Wolf, PHI, 3rd Edn.
[5] VLSI Design, Debaprasad Das, Oxford University Press, New Delhi, 2010.
[6] CMOS Logic Circuit Design, John P. Uyemura, Springer, 2001.
[7] Digital Integrated Circuit Design, Ken Martin, Oxford University Press, 2000.
[8] VLSI Design Technique forAnalog and Digital Circuits, R L Geiger, TMH.

Digital Learning Resources:

Course Name:	VLSI Design
Course Link:	https://nptel.ac.in/courses/117/101/117101058/
Course Instructor:	Prof. A.N. Chandorkar, IIT Bombay

Course Name:	Digital VLSI Testing
Course Link:	https://nptel.ac.in/courses/117/105/117105137/
Course Instructor:	Prof. S, Chattopadhyay, IIT Kharagpur

Course Name:	VLSI Technology
Course Link:	https://nptel.ac.in/courses/117/106/117106093/
Course Instructor:	Dr. Nandita Dasgupta, IIT Madras

7th Semester	REC7D002	Embedded Systems	L-T-P 3-0-0	3 CREDITS

Module-I **(12 hrs)**

Hardware Concepts Embedded System: Application and characteristics of embedded systems, Overview of Processors and hardware units in embedded system, embedded software in a system, Examples of Embedded system.

ARM:ARM pipeline, Instruction Set Architecture ISA: Registers, Data Processing Instructions, Data Transfer Instructions, Multiplication's instructions, Software interrupt, Conditional execution, branch instruction, Swap instruction, THUMB instructions.

Module-II **(8hrs)**

Devices and device drivers: I/O devices, Serial peripheral interfaces,IIC, RS232C, RS422, RS485, Universal serial bus, USB Interface, USB Connector IrDA, CAN, Bluetooth, ISA, PCI, PCI -X and advance busses, Device drivers.

Module –III **(9 hrs)**

Real Time Operating System (RTOS): Real-Time Task Scheduling: Some important concepts, Types of real-time tasks and their characteristics, Task scheduling, Clock-Driven scheduling, Hybrid schedulers, Event-Driven scheduling, Earliest Deadline First (EDF) scheduling, Rate monotonic algorithm (RMA)

Module –IV **(8 hrs)**

Modelling Techniques: Software and programming concept: Processor selection for an embedded system, State chart, SDL, Petri-Nets, Unified Modeling Language (UML). Hardware software codesign. Hardware and software partitioning: K-L partitioning, Partitioning using genetic algorithm,

Module –V **(8 hrs)**

Low power embedded system design: Dynamic power dissipation, Static power dissipation, Power reduction techniques, system level power management. Software design for low power devices.

Books:

[1] "Embedded system architecture, programming and design" By Raj Kamal, TMH.

[2] "Embedded System Design" by SantanuChattopadhay, PHI

[3] Frank Vahid and Tony Givargis, Embedded Systems Design – A unified Hardware /Software Introduction, John Wiley, 2002.

[4] "Hardware software co-design of Embedded systems" By Ralf Niemann, Kulwer Academic.

[5] "Embedded real time system programming" By Sriram V Iyer, Pankaj Gupta, TMH.

Digital Learning Resources:

Course Name:	Embedded Systems
Course Link:	https://nptel.ac.in/courses/108/102/108102045/
Course Instructor:	Prof. Santanu Chaudhary, IIT Delhi

Course Name:	Embedded Systems
Course Link:	https://nptel.ac.in/courses/108/105/108105057/
Course Instructor:	Prof. Amit Patra et al, IIT Kharagpur

Course Name:	Embedded Systems Design
Course Link:	https://nptel.ac.in/courses/106/105/106105159/
Course Instructor:	Prof. Anupam Basu, IIT Kharagpur

7th Semester	REV5D004	Disaster Management	L-T-P 3-0-0	3 CREDITS

Module I (12 hr)

Understanding Disaster: Concept of Disaster - Different approaches- Concept of Risk - Levels of Disasters - Disaster Phenomena and Events (Global, national and regional) Hazards and Vulnerabilities: Natural and man-made hazards; response time, frequency and forewarning levels of different hazards - Characteristics and damage potential or natural hazards; hazard assessment - Dimensions of vulnerability factors; vulnerability assessment - Vulnerability and disaster risk - Vulnerabilities to flood and earthquake hazards

Module II (6 hr)

Disaster Management Mechanism: Concepts of risk management and crisis managements - Disaster Management Cycle - Response and Recovery - Development, Prevention, Mitigation and Preparedness - Planning for Relief

Module III (6 hr)

Capacity Building: Capacity Building: Concept - Structural and Nonstructural Measures Capacity Assessment; Strengthening Capacity for Reducing Risk - Counter-Disaster Resources and their utility in Disaster Management - Legislative Support at the state and national levels

Module IV (12 hr)

Coping with Disaster: Coping Strategies; alternative adjustment processes - Changing Concepts of disaster management - Industrial Safety Plan; Safety norms and survival kits - Mass media and disaster management

Planning for disaster management: Strategies for disaster management planning - Steps for formulating a disaster risk reduction plan - Disaster management Act and Policy in India - Organizational structure for disaster management in India - Preparation of state and district disaster management plans

Books

1. Manual on Disaster Management, National Disaster Management, Agency Govt of India.
2. Disaster Management by Mrinalini Pandey Wiley 2014.

3. Disaster Science and Management by T. Bhattacharya, McGraw Hill Education (India) Pvt Ltd Wiley 2015

1. Earth and Atmospheric Disasters Management, N. Pandharinath, CK Rajan, BS Publications 2009.

2. National Disaster Management Plan, Ministry of Home affairs, Government of India

http://www.ndma.gov.in/images/policyplan/dmplan/draftndmp.pdf

7th Semester	RIP7E002	Intellectual Property Right	L-T-P 3-0-0	3 CREDITS

MODULE-I **(12 Hours)**

Introduction: Intellectual property: meaning, nature and significance, need for intellectual property Right (IPR), IPR in India – Genesis and development, IPR in abroad, Examples: - Biotechnology Research and Intellectual Property Rights Management. What is a patent, what can be protected by a patent, why should I apply for a patent? Patent Law, Patentability requirements, non-Patentable subject matters, Layout of the Patents. Procedure for domestic and international filing of applications, Restoration, Surrender and Revocations of Patents, Rights of Patentee and Working of Patent, Licensing and Enforcing Intellectual Property.

MODULE-II **(10 Hours)**

Copyrights: Copyright: meaning, scope; What is covered by copyright? How long does copyright last? Why protects copyright? Related rights, Rights covered by copyright. Ownership: Duration, Division, Transfer and Termination of Transfers.

MODULE-III **(10 Hours)**

Infringement and Remedies: Literal and non-literal infringement, Role of claims, Doctrines on infringement: Equivalent doctrine, Pith and Marrow doctrine, Comparative test. Defences: Gillette Defence, General grounds, Patents granted with conditions, Parallel import. Remedies: Civil, Administrative.

MODULE-IV **(08 Hours)**

State Law: Trade Secret, Contract, Misappropriation, Right of Publicity Trademarks, Trade Secret - Overview, Requirements, Misappropriation of Trade Secret, Departing Employees, Remedies, Criminal Liability, Misappropriation, Clickwrap Agreements, Idea Submissions; Right of Publicity, Federal Pre-emption, Review.

Books:

[1] W. R. Cornish and D. Llewellyn, Intellectual Property: Patents, Copyrights, Trade Marks and Allied Rights, Sweet & Maxwell.
[2] Lionel Bently and Brad Sherman, Intellectual Property Law, Oxford University Press.
[3] P. Narayanan, Intellectual Property Law, Eastern Law House
[4] B. L. Wadehra, Law Relating to Intellectual Property, Universal Law Publishing Co.
[5] V. K. Ahuja, Law Relating to Intellectual Property Rights, LexisNexis
[6] AjitParulekar and Sarita D'Souza, Indian Patents Law – Legal & Business Implications;Macmillan India ltd, 2006
[7] P. Narayanan; Law of Copyright and Industrial Designs; Eastern law House, Delhi, 2010.

Reference:

[1] The Copyright Act, 1957
[2] The Patent Act, 1970
[3] The Trade Marks Act, 1999
[4] The Designs Act, 2000
[5] The Geographical Indication of Goods Act, 1999
[6] The Protection of Plant Varieties and Farmers' Rights Act, 2001
[7] The Semiconductor Integrated Circuits Layout Design Act, 2000

Digital Learning Resources:

Course Name:	Intellectual Property
Course Link:	https://nptel.ac.in/courses/109/106/109106137/
Course Instructor:	Prof. Feroze Ali, IIT Madras

7th Semester	RGT6A003	Green Technology	L-T-P 3-0-0	3 CREDITS

Module I: (12 Hrs)

Global Warming and its effect:- Introduction and physical definition of global warming, the New Carbon Problem: Accumulation, Long Half-Life, Heating Potential, Carbon Emission Factors, Carbon Absorption in Nature, The Global Emission Situation and its effect in India, The Kyoto and Other Protocols and its view in India, Effect of climate change and its impact. Planning for the Future to reduce global warming:- Steps taken to Control Carbon Emissions universally, Use of Promotional and Punitive Mechanisms for Reducing Carbon in Atmosphere, The General Approach in Planning for the Future, Developing Countrywide Adaptive Measures for Safety of Local People, Developing Mitigative Measures for Global Reduction of Carbon, India's National Action Plan on Climate Change (NAPCC) till date, National Mission for a Green India, The MRV Debate.

Module II: (8 Hrs)

Opportunities in Control of Carbon Emissions and Accumulation:- Essential Steps for Control of Carbon Emissions and Accumulation, Procedure to develop own Priorities and Business Opportunities in India for control of carbon emissions and accumulation, Needs a Mix of Green and Traditional Power Sources in India, A Logical Approach for Carbon Reduction, Need in India —More Forests, Less Deforestation and payment rates procedure for controlling carbon emissions and its Promotional Mechanisms at India. Green Technologies for Energy Production: - Various Technologies Available for Energy Production, Cost Comparison of a Few Typical Systems for Power Generation, Sources of Energy Production Already in Use, Alternative Methods Ready for Use, Green Technologies Needing some Prior R&D Work.

Module III: (10 Hrs)

Green Technologies for Personal and Citywide Application: - Measures to be taken for Green city, Carbon Emission Reduction at Personal Level, Carbon Emission Reduction at Local Authority and Citywide Level, Carbon Emissions from Imports. Green Technologies for Specific Applications:- Promotion of 'Green' Buildings, Guidelines, The Energy Conservation Building Code (ECBC), Green Hotels and Hospitals, Green Technologies for Transport, Green Roads, Ports and Harbours, Industries, Carbon, Carbon Emissions from a Few Selected Industries in India, The Changing Scenario in Cities, Need for Wider Application to Town Planning and Area Re-Development Projects, 'Green' Infrastructure for Municipal Services, Bringing up Indian Villages, Green Services for Crematoria, Spreading Message to all Stakeholders.

Module IV: (10 Hrs)

Some High-tech Measures for Reducing Carbon Emissions: - Use of Solar Power with Satellite-Based Systems, Use of Carbon Capture and Storage (Sequestration), Microorganisms, A Quick SWOT Analysis.Recommended Plan of Action: - India's National Action Plan Take Us to a Low-Carbon Path, The Missions Help Develop Awareness, few case studies on Projects undertakenby Various Countries, Adaptive Measures Essential for Indian People to Cope with Climate Change

Books

[1] Green Technologies, Soli J. Arceivala, McGraw Hill Education
[2] Green Technologies and Environmental Sustainability edited by Ritu Singh, Sanjeev

Kumar

Digital Learning Resources:

Course Name: Sustainable Materials and Green Buildings
Course Link:https://nptel.ac.in/courses/105/102/105102195/
Course Instructor:Dr. B. Bhattacharjee, IIT Delhi

7th Semester	RIT7D001	Internet of Things	L-T-P 3-0-0	3 CREDITS

Module-1

Introduction-Definition & Characteristics of IoT, Physical Design of IoT- Things in IoT, IoT Protocols, Logical Design of IoT- IoT Functional Blocks, IoT Communication Models, IoT Communication APIs , IoT Enabling Technologies- Wireless Sensor Networks , Cloud Computing, Big Data Analytics , Communication Protocols , Embedded Systems, IoT Levels & Deployment Templates.

Module-2

Domain Specific IoTs

Home Automation: Smart Lighting, Smart Appliances, Intrusion Detection, Smoke/Gas Detectors, Cities-Smart Parking, Smart Lighting, Smart Roads, Structural Health Monitoring, Surveillance, Emergency Response,

Environment-Weather Monitoring, Air Pollution Monitoring, Noise Pollution Monitoring, Forest Fire Detection , River Floods Detection , **Energy**- Smart Grids , Renewable Energy Systems , Prognostics , Retail-Inventory Management , Smart Payments , Smart Vending Machines , **Logistics**-Route Generation & Scheduling , Fleet Tracking , Shipment Monitoring , Remote Vehicle Diagnostics, **Agriculture**-Smart Irrigation ,Green House Control ,**Industry** -Machine Diagnosis & Prognosis Indoor Air Quality Monitoring ,Health & Lifestyle -Health & Fitness Monitoring, Wearable Electronics

IoT and M2M Introduction, M2M-Difference between IoT and M2M, SDN and NFV for IoT-Software Defined Networking , Network Function Virtualization

Module-3

IoT Platforms Design Methodology

IoT Design Methodology-Purpose & Requirements Specification, Process Specification, Domain Model Specification, Information Model Specification , Service Specifications , IoT Level Specification, Functional View Specification , Operational View Specification , Device & Component Integration , Application Development, Case Study on IoT System for Weather Monitoring, Motivation for Using Python

IoT Physical Devices & Endpoints

What is an IoT Device-Basic building blocks of an IoT Device, Exemplary Device: Raspberry Pi, About the Board, Linux on Raspberry Pi , Raspberry Pi Interfaces – Serial, SPI , I2C , Programming Raspberry Pi with Python-Controlling LED with Raspberry Pi , Interfacing an LED and Switch with Raspberry Pi ,Interfacing a Light Sensor (LDR) with Raspberry Pi , Other IoT Devices- pcDuino, Beagle Bone Black , Cubieboard

Module-3

IoT &Beyond : Use of Big Data and Visualization in IoT, Industry 4.0 Concepts. Overview of RFID, Low-power design (Bluetooth Low Energy), range extension techniques (data mining and mesh networking), and dataintensive IoT for continuous recognition applications. Overview of Android / IOS App Development tools & Internet Of Everything

Books:

1. Internet of Things, A Hands on Approach, by ArshdeepBahga& Vijay audisetti, University Press.
2. The Internet of Things, by Michael Millen, Pearson

7th Semester	RIS7B001	Industrial Safety Engineering	L-T-P 3-0-0	3 CREDITS

Module-I: **(7 hours)**

Industrial safety: Accident, causes, types, results and control, mechanical and electrical hazards, types, causes and preventive steps/procedure, describe salient points of factories act 1948 for health and safety, wash rooms, drinking water layouts, light, cleanliness, fire, guarding, pressure vessels, etc, Safety color codes. Fire prevention and firefighting, equipment
and methods.

Module-II **(7 hours)**

Fundamentals of maintenance engineering: Definition and aim of maintenanceengineering, Primary and secondary functions and responsibility of maintenance department, Types of maintenance, Types and applications of tools used for maintenance, Maintenance cost & its relation with replacement economy, Service life of equipment.

Module-III:(7 hours)

Wear and Corrosion and their prevention: Wear- types, causes, effects, wear reduction methods, lubricants-types and applications, Lubrication methods, general sketch, working and applications, i. Screw down grease cup, ii. Pressure grease gun, iii. Splash lubrication, iv. Gravity lubrication, v. Wick feed lubrication vi. Side feed lubrication, vii. Ring lubrication, Definition, principle and factors affecting the corrosion. Types of corrosion, corrosion prevention methods.

Module-IV: **(7 hours)**

Fault tracing: Fault tracing-concept and importance, decision treeconcept, need and applications, sequence of faultfinding activities, show as decision tree, draw decision tree for problems in machine tools, hydraulic, pneumatic,automotive, thermal and electrical equipment's like, I. Any one machine tool, ii. Pump iii. Air compressor, iv. Internal combustion engine, v. Boiler, vi. Electrical motors, Types of faults in machine tools and their general causes.

Module-V: **(8 hours)**

Periodic and preventive maintenance: Periodic inspection-concept and need,degreasing, cleaning and repairing schemes, overhauling of mechanical components,overhauling of electrical motor, common troubles and remedies of electric motor, repaircomplexities and its use, definition, need, steps and advantages of preventive maintenance. Steps/procedure for periodic and preventive maintenance of: I. Machine tools, ii. Pumps, iii. Air compressors, iv. Diesel generating (DG) sets, Program and schedule of preventive maintenance of mechanical and electrical equipment, advantages of preventive maintenance. Repair cycle concept and importance

Books:

1. Maintenance Engineering Handbook, Higgins & Morrow, Da Information Services.
2. Maintenance Engineering, H. P. Garg, S. Chand and Company.
3. Pump-hydraulic Compressors, Audels, McGraw Hill Publication.
4. Foundation Engineering Handbook, Winterkorn, Hans, Chapman & Hall London.

7th Semester	RCS7D007	Soft Computing	L-T-P 3-0-0	3 CREDITS

Module I: **(14 Hrs)**

Basic tools of soft Computing: Fuzzy logic, Neural Networks and Evolutionary Computing, Approximations of Multivariate functions, Non - linear Error surface and optimization

Fuzzy Logic Systems: Basics of fuzzy logic theory, Crisp and fuzzy sets; Basic set operations; Fuzzy relations, Composition of Fuzzy relations, Fuzzy inference, Zadeh's compositional rule of inference; Defuzzification; Fuzzy logic control; Mamdani and Takagi and Sugeno architectures. Applications to pattern recognition.

Module II: **(14 Hrs)**

Neural networks: Single layer networks, Perceptron; Activation functions; Adaline- its training and capabilities, weights learning, Multilayer perceptrons; error back propagation, generalized delta rule; Radial basis function networks and least square training algorithm, Kohenen self - organizing map and learning vector quantization networks; Recurrent neural networks, Simulated annealing neural networks; Adaptive neuro-fuzzy information; systems (ANFIS).

Module III: **(8 Hrs)**

Evolutionary Computing: Genetic algorithms: Basic concepts, encoding, fitness function, reproduction. Differences of GA and traditional optimization methods. Basic genetic, basic evolutionary programming concepts Applications, hybrid evolutionary algorithms.

Books:

1. F. O. Karry and C. de Silva, "Soft Computing and Intelligent Systems Design - Theory, Tools and Applications". Pearson Education.(Printed in India).
2. J. S. R. Jang. C. T. Sun and E. Mizutani, "Neuro-fuzzy and soft-computing". PHI Pvt. Ltd., New Delhi.
3. Fredric M. Ham and Ivica Kostanic, "Principle of Neuro Computing for Science and Engineering", Tata McGraw Hill.
4. S. Haykins, "Neural networks: a comprehensive foundation". Pearson Education, India. 4) V. Keeman,"Learning and Soft computing", Pearson Education, India.
5. R. C. Eberhart and Y. Shi, "Computational Intelligence Concepts to Implementation". Morgan Kaufmann Publishers (Indian Reprint).

7th Semester		Essence of Indian Knowledge Tradition - II	L-T-P 3-0-0	3 CREDITS

Course Objectives:

1. To facilitate the students with the concepts of Indian traditional knowledge and to make them understand the Importance of roots of knowledge system.
2. To make the students understand the traditional knowledge and analyse it and apply it to their day to day life

Course Outcomes :

At the end of the Course, Student will be able to:

1. Identify the concept of Traditional knowledge and its importance.
2. Explain the need and importance of protecting traditional knowledge.
3. IIllustrate the various enactments related to the protection of traditional knowledge.
4. Interpret the concepts of Intellectual property to protect the traditional knowledge.
5. Explain the importance of Traditional knowledge in Agriculture and Medicine.

Module-1:

Introduction to traditional knowledge: Define traditional knowledge, nature and characteristics, scope and importance, kinds of traditional knowledge, Indigenous Knowledge (IK), characteristics, traditional knowledge vis-a-vis indigenous knowledge, traditional knowledge Vs western knowledge traditional knowledge

Module-2:

Protection of traditional knowledge:The need for protecting traditional knowledge Significance of TK Protection, value of TK in global economy, Role of Government to harness TK.

Module-3:

Legal framework and TK: The Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006, Plant Varieties Protection and Farmer's Rights Act, 2001 (PPVFR Act); The Biological Diversity Act 2002 and Rules 2004, the protection of traditional knowledge bill, 2016.

Module-4:

Traditional knowledge and intellectual property: Systems of traditional knowledge protection, Legal concepts for the protection of traditional knowledge, Patents and traditional knowledge, Strategies to increase protection of traditional knowledge

Module-5:

Traditional Knowledge in Different Sectors: Traditional knowledge and engineering, Traditional medicine system, TK in agriculture, Traditional societies depend on it for their

food and healthcare needs, Importance of conservation and sustainable development of environment, Management of biodiversity, Food security of the country and protection of TK

Books:

1. Traditional Knowledge System in India, by Amit Jha, 2009.

2. Traditional Knowledge System in India by Amit Jha Atlantic publishers, 2002.

3. "Knowledge Traditions and Practices of India" Kapil Kapoor, Michel Danino.

Digital Learning Resources:

Course Name:	Ayurvedic Inheritance of India
Course Link:	https://nptel.ac.in/courses/121/106/121106003/
Course Instructor:	Dr M. S. Valiathan, IIT, Madras

https://www.youtube.com/watch?v=LZP1StpYEPM

EIGHTH SEMESTER(COMMON TO ALL BRANCHES OF B.Tech)							
Theory							
Sl No	**Category**	**Course Code**	**Course Title**	**L-T-P**	**Credit**	**University Marks**	**Internal Evaluation**
-	-	-	-		0		
				Total Credit (Theory)	**0**		
				Total Marks			
				Practical			
1	PSI	RMP8H201	Major Project / Internship	0-0-12	6		400
				Total Credit (Practical)	**6**		
				Total Semester Credit	**6**		
				Total Marks			**400**