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	3	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

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., New Delhi.

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, John Wiley and Sons, INC.

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

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.

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 the Long 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 calculatingdepreciation - 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.

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