

**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
<b>Subject (Theory)</b>							
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				
6	HS	HS2002	Organizational Behaviour	3-0-0	2	100	50
		HS2001	Engineering Economics				
<b>Subject (Sessional / Practical)</b>							
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
<b>Total</b>				<b>18-0-12</b>	<b>22</b>	<b>600</b>	<b>700</b>

**Note : Minimum four (04) weeks of Summer Course / Training / Internship / Skill Course / etc. after 4<sup>th</sup> Semester.**

[Click here to view/download the syllabus of the subjects.](#)

## **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.

## **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 Reaction 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.

## 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 bar and 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, Belt creep and slip.

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 Sessler, 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 .

## 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, Scitech Publications
2. Fundamentals of Machine Component Design by R.C.Juinall and K.M.Marshek, John Wiley & Sons
3. Machine Design, P.C.Sharma and D.K.Agrawal, S.K.Kataria & Sons
4. Machine Design, Pandya and 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 Coimbatore
3. Design Data HandBook, K.Lingaiah, McGrawHill, 2ndEd. 2003.
4. Design Data Hand Book by K.Mahadevan and B.Reddy, CBS Publishers

## 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:**

1. Gain foundational knowledge of various machine learning models such as logistic regression, multilayer perceptrons, and convolutional neural networks.
2. Apply machine learning models to address complex problems in different fields such as medical diagnostics, image recognition, and text prediction.
3. Perform hands-on tasks using PyTorch and other open-source libraries to implement machine-learning algorithms.
4. Identify potential opportunities for implementing machine learning to resolve user problems.
5. Use the data science process to effectively manage and organize machine learning projects.
6. 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:**

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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:**

1. Ability to recognize different data elements in various scenarios and explain the necessity for a Big Data Infrastructure Plan and Information System Design.
2. Ability to select suitable data models for specific types of data and apply techniques for handling streaming data.
3. Proficiency in retrieving data from different databases and big data management systems, and identifying when a big data problem needs data integration.
4. Capability to execute basic big data integration and processing on Hadoop and Spark platforms.
5. 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.
6. 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 Data Integration  
Learn By Doing: Putting MongoDB and Spark to Work  
Processing Big Data  
Retrieving Big Data

**Formative**

10 graded

**Assessments:**

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**

11 graded

**Assessments:**

quizzes.

**ASSESSMENT:**

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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:**

1. Understand and implement basic and advanced Python concepts, including the use of libraries like Pandas, Numpy & Beautiful Soup.
2. Develop the ability for data collection, manipulation, and web scraping using Python.
3. Apply foundational Python skills to develop Artificial Intelligence (AI) enabled applications with Python and Flask.
4. Employ different Python techniques to develop web applications, write unit tests, and package applications for distribution.
5. Gain a thorough understanding of SQL and how Python interacts with databases using Object-Relational Mapping (ORM) with Django.
6. 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:**

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## 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:**

1. Understand and apply key distributed computing concepts for cloud computing including clouds, MapReduce, and NoSQL stores.
2. Utilize modern cloud technologies and the architecture behind the Cloud Systems and Infrastructure, and how virtualization and containers play a role.
3. Grasp how cloud service providers like Amazon, Google, and Microsoft organize their services and offerings.
4. Apply knowledge of cloud middleware technologies such as RPC and REST, JSON and load balancing for cloud-based applications.
5. Comprehend the operational aspects of cloud storage services such as Hive, HDFS, Ceph, cloud object storage systems, and more.
6. 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 Concurrency Emerging Classical Real-Life Behaviors	Distributed and	Algorithms Replication	Continued Control Paradigms Systems
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**Formative**

6 quizzes and 1 coding/lab assignment.

**Assessments:****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  
 Cloudbconomics  
 Foundations: Containers, Virtual Machine, JVM  
 MAAS, PAAS, Web Services  
 Storage: Ceph, SWIFT, HDFS, NAAS, SAN, Zookeeper

**Formative**

4 quizzes.

**Assessments:****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 Systems  
 Streaming  
 Big Data Machine Learning Introduction  
 Graph Processing and Machine Learning

**Formative**

4 quizzes.

**Assessments:****ASSESSMENT:**

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## 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:**

1. Understand, compare, and explain how telephony and media delivery networks operate.
2. Understand circuit switched networks and packet switched networks and their trade-offs.
3. Comprehend key innovations that have transformed the communication, entertainment, and consumer electronics industry.
4. Describe the DragonBoard™ 410c peripherals, I/O expansion capabilities, computing capabilities, and connectivity capabilities.
5. Use Linux terminal for embedded purposes and configure integrated development environment (IDE) for software development.
6. 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.*

## 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:**

1. Understand how to design robotic bodies and behaviors for efficient and reliable mobility in a dynamic world.
2. Apply the concept of kinematics and dynamics in designing legged machines and robots.
3. Develop sensorimotor programs through simple dynamical abstractions.
4. Comprehend the transformation process of images and videos into 2D representations for efficient grasping and navigation.
5. Identify the calculation of 3D posing of objects to facilitate manipulation tasks.
6. 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:**

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## 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:**

1. Gain knowledge of Local Area Networks, TCP/IP, the OSI Framework, and routing basics, and comprehend how networking affects security systems within an organization.
2. Learn about common vulnerabilities in various databases including SQL, Oracle, Mongo, and Couch, and apply knowledge to mitigate risks such as SQL Injection.
3. Apply generative AI tools to combat cyber threats by detecting vulnerabilities and automating the creation of cybersecurity content like playbooks and threat intelligence reports.
4. Develop skills to perform penetration testing using various tools, gather essential data, and understand the phases of testing to improve organizational security.
5. 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.
6. 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:**

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## 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 the Resistance 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 (08 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 asset, 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.

## **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.

**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

### **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.

**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.