## LIST OF OPEN ELECTIVES TO BE OFFERED IN THE ODD SEMESTER (MIT CAMPUS)

<table>
<thead>
<tr>
<th>SL. NO.</th>
<th>COURSE CODE</th>
<th>COURSE TITLE</th>
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OBJECTIVES

- Study about the common unit operations carried out in process industries.
- To gain knowledge about the important unit operations taking place in process industries.
- Take up a case study on selected process industries like petrochemical industry, power plant industry and paper & pulp industry to make the students understand the different measurement and control techniques for important processes.
- Facilitate the students to apply knowledge to select appropriate measurement technique and control strategy for a given process.

UNIT I  COMMON UNIT OPERATIONS IN PROCESS INDUSTRIES - I  9
Unit Operation, Measurement and Control :-Transport of solid, liquid and gases - Evaporators – Crystallizers-Dryers.

UNIT II  COMMON UNIT OPERATIONS IN PROCESS INDUSTRIES - II  9
Unit Operation, Measurement and Control :- Distillation – Refrigeration processes – Chemical reactors.

UNIT III  PROCESS MEASUREMENT AND CONTROL IN PETROCHEMICAL INDUSTRY  9

UNIT IV  PROCESS MEASUREMENT AND CONTROL IN THERMAL POWERPLANT INDUSTRY  9
Process flow diagram of Coal fired thermal Power Plant– Coal pulverizer - Deaerator – Boiler drum - Superheater – Turbines.

UNIT V  PROCESS MEASUREMENT AND CONTROL IN PAPER & PULP INDUSTRY  9
Process flow diagram of paper and pulp industry – Batch digestor – Continous sulphate digestor – Control problems on the paper machine.

TOTAL : 45 PERIODS

OUTCOMES

- Would have gained knowledge on common unit operations in process industries
- Understand the dynamics of important unit operations in petrochemical industry
- Would have developed the understanding of important processes taking place selected case studies namely petrochemical industry, power plant industry and paper & pulp industry
- Gained ability to select appropriate measurement techniques for selective processes.
- Acquired knowledge to select controller structure based on the process knowledge.

TEXT BOOKS:
EI7592 INTRUDUCTION TO INDUSTRIAL INSTRUMENTATION AND CONTROL

OBJECTIVES
- To give an adequate knowledge about various techniques used for various parameters of measurement in Industries.
- To provide exposure to four important process variables namely level, pressure, flow and temperature.
- To understand, analyze and design various measurement schemes that meet the desired specifications and requirements of real time processes.
- To acquire knowledge about the principles of conventional continuous controllers namely ON/OFF and PID controller.
- To get an overview of advanced control schemes used for industrial applications.

UNIT I LEVEL AND PRESSURE MEASUREMENT

UNIT II TEMPERATURE MEASUREMENT

UNIT III FLOW MEASUREMENT

UNIT IV PROCESS CONTROL

UNIT V ADVANCED CONTROL SCHEMES
Ratio Control – Feed forward control - Cascade control – Model predictive control – Examples from boiler systems and distillation column.

TOTAL : 45 PERIODS
OUTCOME:
- Apply the knowledge about the instruments to use them more effectively
- Ability to select appropriate level and pressure measuring instruments according to the application
- Ability to design signal conditioning circuits and compensation schemes
- Able to understand the different conventional control actions, their relative merits, demerits and their typical applications.
- Able to analyze the need for advanced control and methods of implementation of these control techniques.

TEXT BOOKS:

REFERENCES:

AE7591 FUNDAMENTALS OF JET PROPULSION

OBJECTIVES:
- To understand the principles of operation of jet and rocket propulsion.
- Also to understand about the types, operation and performance of various parts of the gas turbine engines.

UNIT I FUNDAMENTALS OF GAS TURBINE ENGINES

UNIT II BASICS OF GAS TURBINE ENGINE COMPONENTS

UNIT III RAMJET PROPULSION

UNIT IV HYPERSONIC AIRBREATHING PROPULSION
Introduction to hypersonic air breathing propulsion, hypersonic vehicles and supersonic combustion- need for supersonic combustion for hypersonic propulsion – salient features of scramjet engine and its applications for hypersonic vehicles – problems associated with supersonic combustion – engine/airframe integration aspects of hypersonic vehicles
UNIT V ROCKET PROPULSION  

TEXT BOOKS:

REFERENCES:

AE7592 THEORY OF FLIGHT  
L T P C
3 0 0 3

OBJECTIVE:
To introduce the concepts of flying, International standard atmosphere, structural aspects of airplanes, brief description of systems of instruments used in airplanes and power plants used.

UNIT I HISTORY OF FLIGHT  
Balloon flight–ornithopers-Early Airplanes by Wright Brothers - biplanes and monoplanes - Developments in aerodynamics, materials, structures and propulsion over the years.

UNIT II TYPES AND CONTROL OF AIRPLANES  
Different types of flight vehicles, classifications-Components of an airplane and their functions- Conventional control, powered control- Basic instruments for flying-Typical systems for control actuation.

UNIT III FUNDAMENTALS OF AERODYNAMICS  
Physical Properties and structures of the Atmosphere - Temperature, pressure and altitude relationships - Newton’s Law of Motion applied to Aeronautics-Evolution of lift, drag and moment - Aerofoils -.airframe components and their functions – Performance and introduction to stability and control.

UNIT IV FUNDAMENTALS OF AIRBREATHING PROPULSION  
Basic ideas about piston, turboprop and jet engines – use of propeller and jets for thrust production – Aircraft performance estimation using engine performance parameters

UNIT V FUNDAMENTALS OF SPACE FLIGHT  
Principle of operation of rocket - types of rocket and typical applications - Exploration into space-equation for space flight – two dimensional rocket motion - rocket trajectories – multistaging – rocket performance

TOTAL :45 PERIODS
OUTCOMES:
On completion of the course, the students will understand the basic concepts of airplane aerodynamics, control of airplanes, air-breathing propulsion and rocket flight.

TEXT BOOKS

REFERENCES

AU7591 FUNDAMENTALS OF AUTOMOBILE ENGINEERING

OBJECTIVE:
To understand the basics and working principles of various systems of an automobile.

UNIT I VEHICLE STRUCTURE AND ENGINE

UNIT II TRANSMISSION SYSTEM

UNIT III STEERING, BRAKE AND SUSPENSION SYSTEMS

UNIT IV AUTOMOTIVE ELECTRICAL AND ELECTRONICS

UNIT V SAFETY AND EMERGING TRENDS IN AUTOMOTIVE VEHICLES

OUTCOME:
The students able to identify the different components in an automobile and have clear understanding on working principle of different systems of an automobile.

TEXT BOOK:
REFERENCES:

AU7592 AUTOMOTIVE SAFETY  L T P C
3 0 0 3

OBJECTIVES:
- The course should enable the students to:
- Know about the basics about the vehicle.
- Understand the safety aspects in the vehicle.
- Know and understand the various safety aspects.
- To get the knowledge in sensors provided in the vehicle to avoid the crash and to detect the defects in the vehicle.
- To know about the comfort and convenience system.

UNIT I INTRODUCTION 9

UNIT II PASSIVE SAFETY CONCEPTS 9

UNIT III PASSIVE SAFETY EQUIPMENTS AND CONVENIENCE SYSTEM 9
Seat belt, Seat belt tightener system and importance, collapsible steering column. Air bags and its activation. Designing aspects of automotive bumpers and materials for bumpers. Steering and mirror adjustment, central locking system, Tire pressure control system, rain sensor system, automated wiper system.

UNIT IV ACTIVE SAFETY 9
Antilock braking system, Stability Control. Adaptive cruise control, Lane Keep Assist System, Collision warning, avoidance system, Blind Spot Detection system, Driver alertness detection system.

UNIT V VEHICLE INTEGRATION AND NAVIGATION SYSTEM 9

TOTAL: 45 PERIODS

OUTCOMES:
The students should be able to:
- Know about the design of the bumper for safety.
- Know about the concept of crumble zone, and also the effect of acceleration and deceleration of the vehicle in the compartment of the vehicle.
- Know the various types of safety aspects such as active and passive safety, the active safety components and the working passive safety components such as air bags, seat belts.
- Know the working of the compartment while moving of the vehicle, about the collapsible steering and tiltable steering column, about the collision avoidance system, front and rear object detection.
• Know about the rear vehicle detection system, and the braking system, the comfort and convenience system for the vehicle such as central locking system, garage door opening system and about the environment information system.

TEXT BOOK:

REFERENCES:
4. ARAI Safety standard

PR7591 MANUFACTURING TECHNIQUES L T P C
3 0 0 3

OBJECTIVE
The objective of this course is to make the students to learn the various manufacturing techniques.

UNIT I METAL CASTING 9
Sand Casting –Type of patterns - Pattern Materials – Pattern allowances – Moulding sand Properties and testing – Cores –Types and applications –Melting furnaces –Special casting processes- Shellmoulding - Investment casting — Pressure die casting – Centrifugal Casting – Squeeze casting - Stir casting.

UNIT II METAL JOINING 9

UNIT III METAL FORMING 9

UNIT IV MACHINING 9

UNIT V NON-TRADITIONAL MACHINING 9
Abrasive jet machining - Ultrasonic machining -Electric discharge machining –Electro chemical machining,Laser beam machining, plasma arc machining, Electron beam machining, working principles, equipments, effect of process parameters, applications, advantages and limitations.

TOTAL: 45 PERIODS
OUTCOMES:
On completion of the course, the students will be in a position to suggest the suitable manufacturing technique for a given application.

TEXT BOOKS:

REFERENCES:

PR7592 ENGINEERING MANAGEMENT L T P C
3 0 0 3

OBJECTIVE:
• To train the Engineers to manage industrial scenario.

UNIT I PRINCIPLES OF MANAGEMENT AND PERSONNEL MANAGEMENT 7

UNIT II INVENTORY MANAGEMENT 11
Purpose of inventory – Cost related to inventory – Basic EOQ model – variations in EOQ model – Finite Production, quantity discounts – ABC Analysis – MRP.

UNIT III OPERATIONS MANAGEMENT 10

UNIT IV FINANCIAL MANAGEMENT 10

UNIT V MARKETING MANAGEMENT 7

TOTAL: 45 PERIODS

OUTCOMES
• The students after successful completion of the course will be in a position to manage manufacturing and manufacturing related activities in industries and will coordinate better with other departments in the industries.

TEXT BOOKS:
REFERENCES:
7. R. Kesavan, C.Elanchezian and B.Vijayaramnath – Production Planning and Control,

ME7593 OPERATIONS RESEARCH

OBJECTIVE:
To introduce the various quantitative techniques and optimization techniques and to make the
students apply these techniques for modeling and solving many engineering situations in general
and manufacturing situations in particular.

UNIT I LINEAR PROGRAMMING
Problem formulation - Graphical method – simplex method – Special cases –
transportation and assignment method – applications.

UNIT II REPLACEMENT MODELS AND GAME THEORY
Basic replacement model – individual and group replacement problems – applications – game
theory – terminology – decision criteria – solution to a 2 x 2 and 2 x n games – applications
of LP in game theory applications

UNIT III QUEUING MODELS AND SIMULATION
Elements of queue – queue discipline – Poisson arrival and exponential service – queue length
– waiting time – steady state conditions – applications – concept of simulation – Monte Carlo
method – applications.

UNIT IV FORECASTING, SEQUENCING AND LINE BALANCING
Forecasting – purpose – methods – measures of forecast error; scheduling – priority rules -
sequencing – methods of sequencing – Johnson’s rule – Heuristic approach, line
balancing – applications.

UNIT V PROJECT NETWORK ANALYSIS AND DECISION TREE ANALYSIS
Network – CPM/PERT – Project time estimation – critical path – crashing of network, Decision
tree analysis – applications

TOTAL: 45 PERIODS

OUTCOME:
The students shall able to select and apply techniques for typical engineering and industrial
situations.

TEXT BOOKS:
2008.

REFERENCES:
2014.
OBJECTIVE:
To introduce the concept of Green Manufacturing to the students

UNIT I  AIR POLLUTION SAMPLING AND MEASUREMENT  6

UNIT II  NOISE POLLUTION & CONTROL  10
Frequency and Sound Levels, Units of Noise based power radio, contours of Loudness. Effect of human, Environment and properties, Natural and Anthropogenic Noise Sources, Measuring Instruments for frequency and Noise levels, Masking of sound, Types, Kinetics, Selection of different reactors used for waste treatment, Treatment of noise at source, Path and Reception, Sources of noise, Effects of noise-Occupational Health hazards, thermal Comforts, Heat Island Effects, Radiation Effects.

UNIT III  WATER DEMAND, WATER QUALITY  10
Factors affecting consumption, Variation, Contaminants in water, Nitrates, Fluorides, Detergents, taste and odour. Radio activity in water, Criteria, for different impurities in water for portable and non portable use, Point and non-point Source of pollution, Major pollutants of Water, Water Quality Requirement for different uses, Global water crisis issues.

UNIT IV  FIRE SAFETY  10

UNIT V  SAFETY RADIATION PROTECTION  9
Radiation fundamentals-Types of radiation Ionizing and Non-Ionizing radiation, their uses and biological effects. Radioactive waste disposal radioactive soil, water and air and their fate. Treatment and disposal Liquid and solid Radioactive wastes.

TOTAL: 45 PERIODS

OUTCOMES:
- It will create the awareness of air and noise pollution and methods of measurements and control
- It will impart the knowledge of fire safety and its protection

TEXT BOOKS:

REFERENCES:
OBJECTIVES

- To introduce the core data structures of the Python programming language
- To understand the abstract data types like List, Stack, Queue.
- To familiarize the concept of data analysis in python
- To know the data structure representations and to learn the algorithms for sorting and searching.

UNIT I       PYTHON FUNDAMENTALS

Basic Programming elements - Variables, Operators - Python Data types - Strings - Sets - Lists - Dictionaries - Control Structures - assignment, Conditional statements, Looping statements - Functions.

UNIT II      PYTHON PROGRAMMING

Python for Data Analysis - NumPy - Map and Filter functions - Object Oriented Programming - Class & Objects in Python- Data members and Member functions - Polymorphism - Inheritance - Interface

UNIT III     LINEAR DATA STRUCTURES

Abstract Data Types - Arrays - Lists - Stacks and Queues- Linked List based implementation of Stacks and Queues - Applications - Polynomial manipulation - Infix to Postfix Conversion - Postfix Expression Evaluation - CPU Scheduling

UNIT IV      NON LINEAR DATA STRUCTURES


UNIT V       MACHINE LEARNING AND ITS APPLICATIONS WITH PYTHON

Learning - Types of Machine Learning - Data Analysis and Classification - Optical Character Recognition in Images - Intelligent decision making - Robot Path Planning - Automation and Control - Prediction Analytics - Market price prediction using Machine Learning - Case Study

TOTAL: 45 PERIODS

TEXT BOOKS:

REFERENCES:
OBJECTIVES:
- To learn the fundamentals of database systems
- To understand about the design of databases
- To write queries using SQL
- To understand the importance of transactions in databases

UNIT I INTRODUCTION TO DBMS

UNIT II DATABASE DESIGN
Relational Model - Constraints - Keys - Functional Dependencies, - Normalization - First, Second, Third Normal Forms – Boyce/Codd Normal Form - Multi-valued Dependencies and Fourth Normal Form - Join Dependencies

UNIT III DATABASE PROGRAMMING TECHNIQUES
Introduction to SQL – DDL - DML - Data Constraints- Integrity Constraints - Advanced SQL - Views - Functions and Procedures- Triggers - Database Security

UNIT IV INFORMATION RETRIEVAL CONCEPTS
Data Warehouse- Data marts – Characteristics of Data Warehouse – Data Modelling for Data Warehouse – Building a Data Warehouse – Data Mining – Queries in IR systems - Web search and Analysis – Association Rules – Classification – Clustering – Commercial Data Mining Tools - Case Study

UNIT V ADVANCED TOPICS

OUTCOMES:
- Map ER model to Relational model
- Write queries using SQL
- Design the database applications by applying normalization techniques
- Appraise how advanced databases differ from traditional databases
- Explore the information retrieval techniques and various case studies

TEXT BOOKS:

REFERENCES:
OBJECTIVES:
- To understand the overview of artificial intelligence integrated into smart robot systems.
- To understand the planning of the robotic cell.
- To develop new applications in intelligent robotic systems.

UNIT I INTRODUCTION TO SMART ROBOTS

UNIT II ARTIFICIAL INTELLIGENCE FOR SMART ROBOTS

UNIT III SMART ROBOTS

UNIT IV PROGRAMMING AND SIMULATION OF INTELLIGENT ROBOTIC SYSTEMS

UNIT V PLANNING OF ROBOT MOTION
Off-Line Planning of Robot Motion - Collision - Free Path Planning of Robot Manipulator - Time-Trajectory Planner - Planning for Fine Motion and Grasping.

TOTAL: 45 PERIODS

OUTCOMES:
Upon completion of the course, the student will be able to:
- Discuss the basic concepts of smart robots
- Assess the appropriate sensors for the robotic functions
- Evaluate the program the robot for typical applications

TEXT BOOKS:

REFERENCES:
OBJECTIVES:
- To study the various hardware and software used in embedded systems
- To introduce the architectural features, and programming of PIC and ARM microcontrollers
- To learn about the fundamentals of real-time operating systems

UNIT I INTRODUCTION TO EMBEDDED SYSTEMS
Processor Embedded into a System, Embedded Hardware Units and Devices in a System, Embedded Software in a System, Examples of Embedded Systems, Embedded System on-chip (Soc) and Use of VLSI Circuit Design Technology.

UNIT II PIC MICROCONTROLLERS
PIC 16F877 MCU, Architecture, Features, Memory and memory map, I/O ports, Timers and CCP Devices, ADC, Interrupts, Instruction format, Addressing Modes, Instruction Set, Programming with MPLAB IDE.

UNIT III ARM BASED MICROCONTROLLERS
Introduction to 16 bit Processors, ARM Architecture, ARM cortex M3, 16 bit ARM Instruction set, Thumb Instruction set, Exception Handling in ARM, Porting Linux in ARM, Assembly and C programming.

UNIT IV INTERFACING I/O DEVICES
LED, liquid crystal display, Motor (DC, Servo, Stepper), Relays, Keypad, Keyboard, Touch screen, Sensors (thermocouple, force, displacement), SD card, Infrared connectivity.

UNIT V REAL-TIME OPERATING SYSTEM
The challenges of multitasking and real-time, Achieving multitasking with sequential programming, RTOS, Scheduling and the scheduler Developing tasks, Data and resource protection- the semaphore.

OUTCOMES:
Upon successful completion of this course, students will be able to:
- Interface peripherals with microcontrollers
- Design an embedded system in real time
- Develop a real time embedded system for commercial applications.

TEXT BOOKS:

REFERENCES:
OBJECTIVES:
- To introduce the concept of Internet, Networks and its working principles
- To know the scripting languages
- To understand the various applications related to Information Technology

UNIT I WEB ESSENTIALS
Creating a Website - Working principle of a Website - Browser fundamentals - Authoring tools - Types of servers: Application Server - Web Server - Database Server

UNIT II CLIENT-SIDE SCRIPTING ESSENTIALS
Need for Scripting languages - Client side scripting - JavaScript - Introduction - Variables - Data Types - Operators - Arrays - Conditional Statements and Loops - Functions - Objects - Events - Form Validations - Creation of simple scripts

UNIT III SERVER-SIDE SCRIPTING ESSENTIALS
PHP - Working principle of PHP - PHP Variables - Constants - Operators – Flow Control and Looping - Arrays - Strings - Functions - File Handling - PHP and MySQL - PHP and HTML - Development of information systems - Simple database applications

UNIT IV NETWORKING ESSENTIALS
Fundamental computer network concepts - Types of computer networks - Network layers - TCP/IP model - Wireless Local Area Network - Ethernet - WiFi - Network Routing - Switching - Network components

UNIT V MOBILE COMMUNICATION ESSENTIALS

OUTCOMES:
On Completion of the course, the students should be able to:
- Design and deploy simple web-applications
- Create simple database applications
- Develop information system
- Describe the basics of networking and mobile communications

TEXT BOOKS:

REFERENCES:
3. www.w3schools.com
4. https://www.tutorialspoint.com
OBJECTIVE:
- To give an overview of Cloud Computing and its enabling technologies.
- To understand the core concepts in cloud computing.
- Identify cloud services and platforms.
- Understand the Applications, Security requirements and challenges in cloud computing

UNIT I INTRODUCTION

UNIT II CLOUD CONCEPTS AND TECHNOLOGIES

UNIT III CLOUD SERVICES AND PLATFORMS

UNIT IV CLOUD SECURITY

UNIT V APPLICATIONS OF CLOUD COMPUTING

TOTAL : 45 PERIODS

OUTCOMES:
At the end of the course, the student will be able to
- Understand the trade-offs between deploying applications in the cloud over local infrastructure.
- Explain the core concepts and technologies and services of cloud computing paradigm.
- Identify security issues in cloud computing.
- Write comprehensive case studies analyzing and contrasting different cloud computing solutions.

TEXT BOOKS:

REFERENCES: