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

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
FACULTY OF ELECTRICAL ENGINEERING								
DEPARTMENT OF INSTRUMENTATION ENGINEERING								
B.E. Electronics and Instrumentation Engineering								
1.	EI7591	Introduction to Industrial Processes, Measurement and Control	OE	3	3	0	0	3
2.	EI7592	Introduction to Industrial Instrumentation and Control	OE	3	3	0	0	3
3.	EI7593	Introduction to Industrial Data Communication	OE	3	3	0	0	3
FACULTY OF MECHANICAL ENGINEERING								
DEPARTMENT OF AERONAUTICAL ENGINEERING								
B.E. Aeronautical Engineering								
4.	AE7591	Fundamentals of Jet Propulsion	OE	3	3	0	0	3
5.	AE7592	Theory of Flight	OE	3	3	0	0	3
DEPARTMENT OF AUTOMOBILE ENGINEERING								
B.E. Automobile Engineering								
6.	AU7591	Fundamentals of Automobile Engineering	OE	3	3	0	0	3
7.	AU7592	Automotive Safety	OE	3	3	0	0	3
DEPARTMENT OF PRODUCTION TECHNOLOGY								
B.E. Production Engineering								
8.	PR7591	Manufacturing Techniques	OE	3	3	0	0	3
9.	PR7592	Engineering Management	OE	3	3	0	0	3
B.E. Mechanical Engineering								
10.	ME7593	Operations Research	OE	3	3	0	0	3
11.	ME7594	Green Manufacturing Practices	OE	3	3	0	0	3
FACULTY OF INFORMATION AND COMMUNICATION ENGINEERING								
DEPARTMENT OF COMPUTER TECHNOLOGY								
B.E. Computer Science and Engineering								
12.	CS7593	Data Structures with Python	OE	3	3	0	0	3
13.	CS7594	Database System and Applications	OE	3	3	0	0	3
DEPARTMENT OF ELECTRONICS ENGINEERING								
B.E. Electronics and Communication Engineering								
14.	EC7593	Intelligent Robotic Systems	OE	3	3	0	0	3
15.	EC7594	Embedded System Design	OE	3	3	0	0	3
DEPARTMENT OF INFORMATION TECHNOLOGY								
B.Tech. Information Technology								
16.	IT7593	Introduction to Information Technology Essentials	OE	3	3	0	0	3
17.	IT7594	Introduction to Cloud Computing	OE	3	3	0	0	3
FACULTY OF TECHNOLOGY								
DEPARTMENT OF RUBBER AND PLASTICS TECHNOLOGY								
B.Tech. Rubber and Plastics Technology								
18.	RP7591	Polymeric Materials for Engineers	OE	3	3	0	0	3
19.	RP7592	Polymer Properties	OE	3	3	0	0	3

EI7591	INTRODUCTION TO INDUSTRIAL PROCESSES, MEASUREMENT AND CONTROL	L T P C 3 0 0 3

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

Process flow diagram of Petro Chemical Industry - Gas oil separation in production platform –wet gas processing – Fractionization Column – Catalytic Cracking unit – Catalytic reforming unit.

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:

1 Balchan.J.G., and Mumme K.I., “Process Control Structures and Applications”, Van Nostrand Reinhold Company, New York, 1988.

2 Austin G.T and Shreeves, A.G.T., “Chemical Process Industries”, McGraw–Hill International student, Singapore, 1985.

REFERENCES:

1 Waddams, A.L., “Chemical from Petroleum”, Butter and Janner Ltd.,1968.

2 Liptak B.G., “Instrument and Automation Engineers’ Handbook: Process Measurement and Analysis”, Fifth Edition, CRC Press, 2016.

EI7592 INTRODUCTION TO INDUSTRIAL INSTRUMENTATION AND CONTROL **L T P C 3 0 0 3**

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 9

Level Measurements: Float gauge – Displacer – D/P method – Load cell – Capacitive sensor – Ultrasonic sensor. Pressure Measurements: Manometer – Bourdon tube – Capacitive type pressure gauge – Piezo resistive pressure sensor – McLeod gauge – Thermal conductivity gauge.

UNIT II TEMPERATURE MEASUREMENT 9

Thermometers – RTD characteristics and signal conditioning – Thermistors – Thermocouples: Laws – signal conditioning – cold junction compensation. Radiation and optical pyrometers.

UNIT III FLOW MEASUREMENT 9

Orifice plate – venturi tube – Turbine flow meter – Rotameter – Coriolis mass flow meter – Thermal mass flow meter - Electromagnetic flow meter – Ultrasonic flow meter – Introduction to Calibration methods.

UNIT IV PROCESS CONTROL 9

Need for process control – Continuous and Batch processes – servo and regulatory operations – Control valve - Examples: Level process – Flow process - Heat Exchanger.
Controller: ON/OFF – PID controller – Electronic PID controller – Introduction to controller tuning.

UNIT V ADVANCED CONTROL SCHEMES 9

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:

1 Doebelin. E.O and Manik D.N.," Measurement Systems: Application and Design", Special Edition, Tata McGraw Hill Education Pvt. Ltd, 2007
2 Bequette. B. W.," Process Control Modeling, Design and Simulation", Prentice Hall of India, 2004

REFERENCES:

1 Liptak B.G., "Instrument and Automation Engineers' Handbook: Process Measurement and Analysis", Fifth Edition, CRC Press, 2016.
2 Patranabis. D., "Principles of Industrial Instrumentation", 3rd Edition, Tata McGraw Hill, New Delhi, 2010.
3 Stephanopoulos," Chemical Process Control – An Introduction to Theory and Practice", Prentice Hall of India, 2005.

EI7593 INTRODUCTION TO INDUSTRIAL DATA COMMUNICATION L T P C
3 0 0 3

COURSE OBJECTIVES

- To impart the basic concepts of data networks
- To introduce the serial communication interface standards for industrial data networks.
- To familiarize the students with the principles of MODBUS and CANBUS protocols.
- To introduce Foundation Fieldbus and HART Protocols.
- To introduce the principles of Wireless Networks used in Industrial Data Communication

UNIT I DATA NETWORK BASICS 9

Introduction to Data network – OSI Network model – LAN topologies – Ethernet Protocol – Overview of protocols and standards used in Industrial Data Networks.

UNIT II SERIAL COMMUNICATION STANDARDS 9

Introduction to Serial Communication Standards: EIA232, EIA485, I^2C and USB – Features, Elements, Connections and Handshaking.

UNIT III FUNDAMENTALS OF MODBUS AND CANBUS 9

MODBUS:- Overview, Protocol structure, Communication, Request and Response messages and Applications. CANBUS:- Standard and Extended CAN, Message types, Architecture, Data Transmission and Applications.

UNIT IV INTRODUCTION TO FIELDBUS AND HART 9

Fieldbus:- Introduction, Protocol stack, Packet format, types and Applications – HART:- Features, modes, instruction formats and Applications.

UNIT V WIRELESS NETWORKS FOR INDUSTRIAL DATA COMMUNICATION 9

Wired Vs Wireless Communication – Challenges in Wireless Communication - Wireless LAN Protocol fundamentals, Introduction to Wireless HART Protocol.

TOTAL : 45 PERIODS

COURSE OUTCOME

- Acquire knowledge about basic concepts of data networks
- Gain familiarity with various serial interface standards used in industrial data networks.
- Gain knowledge on the principles of MODBUS and CANBUS protocols.
- Get familiarized with Foundation Fieldbus and HART Protocols.
- Gain familiarity with wireless networks for industrial data communication.

TEXT BOOKS

1 Mackay.S, Wrijut.E, Reynders.D and Park.J. “Practical Industrial Data Networks Design, Installation and Troubleshooting”, Newnes Publication, Elsevier, 1st Edition, 2004.

2 Berge.J., “Field Buses for Process Control: Engineering, Operation and Maintenance”, ISA Press, 2004.

3 Berhouz.A. Forouzan, “Data Communications and Networking”, 4th Edition, Tata McGraw Hill, 2007.

REFERENCE BOOKS

1 Buchanan.W., “Computer Buses”, CRC Press, 2000.

2 NPTEL Notes on “Fieldbus Networks” and “Computer Networks”, IIT Kharagpur.

AE7591 FUNDAMENTALS OF JET PROPULSION L T P C
3 0 0 3

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 8

Illustration of working of gas turbine engine – The thrust equation – Factors affecting thrust – Effect of pressure, velocity and temperature changes of air entering compressor – Methods of thrust augmentation – Characteristics of turboprop, turbofan and turbojet – Performance characteristics.

UNIT II BASICS OF GAS TURBINE ENGINE COMPONENTS 9

Subsonic and supersonic inlets for gas turbine engines – inlet performance – axial flow and centrifugal flow compressors and their efficiencies & principle of operation – gas turbine combustion chambers & types – axial flow turbines and their performance – jet engine nozzles and their efficiency

UNIT III RAMJET PROPULSION 8

Operating principle of ramjet engine – various components of ramjet engines and their efficiencies – Combustion in ramjet engine – critical, subcritical and supercritical modes of operation -ramjet engine and its performance characteristics – sample ramjet design calculations – flame stability problems in ramjet combustors –integral ram rockets.

UNIT IV HYPERSONIC AIRBREATHING PROPULSION 9

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 10

Operating principle – specific impulse of a rocket – internal ballistics –solid propellant rockets – selection criteria of solid propellants –liquid propellant rockets – selection of liquid propellants – various feed systems for liquid rockets -thrust control in liquid rockets – cooling in liquid rockets and the associated heat transfer problems – advantages of liquid rockets over solid rockets - introduction to hybrid propulsion – advantages and limitations of hybrid propulsion -.Electrical propulsion - Arcjetresistojet – MPD thrusters, nuclear propulsion.-

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Hill, P.G. & Peterson, C.R. “Mechanics & Thermodynamics of Propulsion” Pearson education (2009).

REFERENCES:

1. Cohen, H. Rogers, G.F.C. and Saravanamuttoo, H.I.H. “Gas Turbine Theory”, Pearson Education Canada; 6th edition , 2008.
2. Oates, G.C., “Aero thermodynamics of Aircraft Engine Components”, AIAA Education Series, New York, 1985.
3. “Rolls Royce Jet Engine” ,Rolls Royce; 4th revised edition, 986.
4. Mathur, M.L. and Sharma, R.P., “Gas Turbine, Jet and Rocket Propulsion”, Standard Publishers & Distributors, Delhi, 2nd edition,2014.

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 7
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 10
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 10
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 9
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 9
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
1. Anderson, J.D., Introduction to Flight, McGraw-Hill; 8th edition, 2015.
2. Stephen.A. Brandt, Introduction to aeronautics: A design perspective, 2nd edition, AIAA Education Series, 2004.

REFERENCES
1. Kermode, A.C. Flight without Formulae, Pearson Education; Eleven edition, 2011.

AU7591 FUNDAMENTALS OF AUTOMOBILE ENGINEERING L T P C
3 0 0 3

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

UNIT I VEHICLE STRUCTURE AND ENGINE 9
History of Automobiles – types of automobile – components of chassis – frame – body - Automotive Engines- types- components of engines-comparison of Two and four stroke engines – construction and working principle –cooling and lubrication system. Merits and demerits of SI and CI engine. Application of SI and CI engine. Emission norms.

UNIT II TRANSMISSION SYSTEM 9

Need for transmission system – types of transmission – clutch – types – working principle and construction- gear box – types – working and construction – Automatic transmission – fluid coupling, torque converter. propeller shaft- slip joint – universal joint – final drive – rear axle.

UNIT III STEERING, BRAKE AND SUSPENSION SYSTEMS 9

Steering system requirements and functions-Steering geometry- Ackermann and Davis steering principle- Wheel alignment parameters – wheels – types of wheels- tyres – types of tyres – steering system components – power steering. Braking system – need – classification – mechanical and hydraulic brake system. Suspension system- types – front suspension – wisebone independent front suspension – rear suspension – leaf spring suspension. Dampers.

UNIT IV AUTOMOTIVE ELECTRICAL AND ELECTRONICS 9

Batteries- types – working and construction – lead acid battery. Starter motor. Charging system-alternator – control unit. Spark plug – ignition system. Vehicle lighting- head lamp. Automotive sensors and transducers- types – application.

UNIT V SAFETY AND EMERGING TRENDS IN AUTOMOTIVE VEHICLES 9

Active and passive safety – safety devices –safety regulations - seat belt- air bag- traction control-collision warning and avoidance system. Climate control. Keyless entry. Cruise control. Drive by wire. Automotive infotronics. Driverless cars.

TOTAL: 45 PERIODS

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:

1. K K Ramalingam, “Fundamentals of Automobile Engineering”, Scitech publications (India) Pvt. Ltd.

REFERENCES:

1. Ganesan V. “Internal Combustion Engines”, Third Edition, Tata McGraw-Hill, 2007.
2. Newton , Steeds and Garet, “Motor Vehicles”, Butterworth Publishers,1989.
3. William H Crouse, “Automotive Mechanics ”,The McGraw-Hill companies,2007
4. K K Ramalingam, “Automobile Engineering theory and practice”, second edition, Scitech publications (India) Pvt.Ltd.

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

Automotive safety: Introduction, Types. Active safety: driving safety, conditional safety, perceptibility safety, operating safety. Passive safety: exterior safety, interior safety.

UNIT II PASSIVE SAFETY CONCEPTS 9

Design of body for safety, deceleration of vehicle, passenger. Concept of crumble zone, Safety Cage. Optimum crash pulse, deceleration on impact with stationary and movable obstacles. Deformation behavior of vehicle body. Deformation behavior of Lightweight materials.

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

Looking out sensors and Looking in sensors, Intelligent vision system, Vehicle Integration system. Global Positioning System. Vehicle Navigation System. Road Network,

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:

1. Ljubo Vlacic, Michel Parent, Fumio Harashima –"Intelligent Vehicle Technologies Theory and Applications" -Butterworth-Heinemann, 2001
2. J. Marek, H.-P. Trah, Y. Suzuki, I. Yokomori -"Sensors for Automotive Applications "-WILEY-VCH Verlag GmbH & Co. 2003
3. Robert Bosch GmbH -"Safety, Comfort and Convenience Systems"-Wiley; 3rd edition, 2007

REFERENCES:

1. Bosch, "Automotive Hand Book", 6th edition, SAE, 2004.
2. J.Powloski -"Vehicle Body Engineering" -Business books limited, London -1969.
3. Ronald.K.Jurgen -"Automotive Electronics Handbook" -Second edition- McGraw -Hill Inc., -1999.
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
Type of Gas welding – Flame characteristics – Filler and Flux materials – Arc welding, Electrodes, Coating and specifications – Principles and types of Resistance welding – Gas metal arc welding – Submerged arc welding – Electro slag welding – Gas Tungsten arc welding –Plasma arc welding – Thermit Welding – Electron beam welding – Friction welding and Friction stir welding.

UNIT III METAL FORMING 9
Forging, Rolling, Extrusion, rod/wire drawing and tube drawing –HERF techniques–Superplastic forming techniques – Hydro forming–Stretch forming–Water hammer forming–Principles and process parameters– Advantage, Limitations and application.

UNIT IV MACHINING 9
Lathe – operations performed in Lathe –Drilling machines – operations performed in drilling machines – Milling machines – operations performed in milling machines –Grinding machines – operations performed in grinding machines.

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:

1. R.K. Jain – Production Technology – Khanna Publishers, 2001.
2. P.C.Sharma – A textbook of Production Engineering – S.Chand and Company Pvt. Limited, 2015.

REFERENCES:

1. Jain .P.L., “Principle of Foundry Technology” , Tata McGraw Hill ,4th edition, 2004.
2. Parmer .R.S , “Welding Engineering and Technology”, Khanna Publishers , 2004.
3. Nagpal G.R. ,”Metal forming processes”, Khanna Publishers, New Delhi, 2nd edition 2009
4. HajraChoudharyetal, “Elements of Production Technology –Vol.II”, Asia Publishing House, 2000.
5. Jain V.K., “Advanced machining process”, Allied Publisher, Delhi, 2002.

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
General principles of management – management functions – organization – types –comparison – functions of personnel management – recruitment training leadership/motivation –communication – conflict – Industrial relations – trade union.

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
Plant Location – Layout – Materials Handling – Method study – Time study – Ergonomics – Aggregate Planning – Value Analysis.

UNIT IV FINANCIAL MANAGEMENT 10
Capital – Types – sources – break even analysis – financial statements – income statement – balance sheet – capital budgeting – working capital management – inventory pricing.

UNIT V MARKETING MANAGEMENT 7
Functions of marketing – Sales promotion methods – advertising – product packaging –marketing variables – distribution channels – organization – market research – market research

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 coordinatebetter with other departments in the industries.

TEXT BOOKS:

1. R.Kesavan, C.Elanchezhian and T.Sundar Selwyn – Engineering Management – Eswar Press, 2005.
2. R. Panneerselvam – Production and Operations Management – Prentice Hall of India, 2003.

REFERENCES:

1. Koontz and Odonnel-Essentials of Management, McGraw Hill 1992.
2. Philips Kotler – Principles of marketing, Prentice Hall of India, 1995.
3. I.M.Pandey – Financial Management, Vikas Publishing house, 1995
4. K.K.Ahuja – Personnel Management, Kalyane Publication 1992.
5. K.Panneerselvam – Production and Operations Management – Prentice Hall of India, 2003.
6. Martand T. Telesand – Industrial and Business Management – S.Chand & Co., 2001
7. R. Kesavan, C.Elanchezian and B.Vijayaramnath – Production Planning and Control,
8. Anuratha Publishing Co. Ltd., Chennai – 2008.

ME7593 OPERATIONS RESEARCH L T P C
3 0 0 3

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 9

Problem formulation - Graphical method – simplex method – Special cases – transportation and assignment method – applications**.**

UNIT II REPLACEMENT MODELS AND GAME THEORY 9

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 9

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 9

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 9

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:

1. Panneerselvam R., "Operation Research", Prentice Hall of India, 2008.
2. Hamdy A.Taha, "Operations Research – An Introduction", Prentice Hall of India, 8th edition 2008.

REFERENCES:

1. Guptha. P.K. and Man-Mohan, "Problems in Operations Research", Sultan chand and Sons, 2014.
2. Monks. J.G, "Operations Management theory and Practice", McGraw Hill, 2nd edition 1996.
3. Ravindran, Philips and Sojberg, "Operations Research Principles and Practice", John Wiley and Sons, Singapore, 2nd edition,2007.
4. Sharma J.K., "Operations Research Theory and Applications", Macmillan India Ltd., 4th edition, 2009.

ME7594 GREEN MANUFACTURING PRACTICES L T P C
3 0 0 3

OBJECTIVE:

To introduce the concept of Green Manufacturing to the students

UNIT I AIR POLLUTION SAMPLING AND MEASUREMENT 6

Primary and Secondary Pollutants, Automobile Pollutants, Industrial Pollution, Ambient air quality Standards, Metrological aspects of air Pollution, Temperature lapse Rates and Stability-wind velocity and turbulence-Pump behavior dispersion of air Pollutants- solution to the atmosphere dispersion equation-the Gaussian Plume Model, Air pollution sampling-collection of gaseous air pollutants-collection of particulate pollutants-stock sampling, analysis of air pollutants-sulfur dioxide-nitrogen dixide, carbon monoxide, oxidants and ozone.

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 Anthrogenic 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

Basic Elements, Causes, Industrial Fires, Explosions, Effects on Environmental, Property & Human Loss, Prevention technique, Building Design, Fire Protection System, contingency plan, Emergency preparedness, Evacuation.

UNIT V SAFETY RADIATION PROTECTION 9

Radiation fundamentals-Types of radiation lonizing and Non-lonizing 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:

1. Dornfield David, Green Manufacturing, Springer, 2012
2. Davim.J.Pauls, Green Manufacturing Processes and Systems, Springer, 2013

REFERENCES:

1. Cairncrss and Francis – Costing the earth – Harvard Business School Press – 2009
2. Gradel.T.E. and B.R. Allenby – Industrial Ecology – Prentice Hall – 2010
3. World Commission on Environment and Development (WCED), Our Common Future, Oxford University Press 2005.

CS7593 DATA STRUCTURES WITH PYTHON L T P C
3 0 0 3

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 9

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

UNIT II PYTHON PROGRAMMING 9

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 9

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 9

Trees - Binary Tree- Binary Search tree - Representation and Traversal Techniques - Expression Trees - Searching - Linear, Binary Search - Searching - Linear, Binary Search - Indexing and Hashing

UNIT V MACHINE LEARNING AND ITS APPLICATIONS WITH PYTHON 9

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:

1. Lambert, Kenneth. Fundamentals of Python: Data Structures. Nelson Education, 2014.
2. Downey, Alley B. "Think Python: How To Think Like A Computer Scientist, 2nd Edition, v 2.2.20 Needham, Massachusetts.", 2015.

REFERENCES:

1. Ellis Horowitz and Sartaj Sahni, Fundamentals of Data Structures, Galgotia Book Sorce,
2. Gurgaon, 1976.
3. McKinney, Wes. Python for data analysis 2E: Data wrangling with Pandas, NumPy, and IPython. " O'Reilly Media, Inc.", 2016.
4. Lutz, Mark. Learning python. " O'Reilly Media, Inc.", 2013.
5. Müller, Andreas C., and Sarah Guido. Introduction to machine learning with Python. O'Reilly Media, 2017.

CS7594 DATABASE SYSTEM AND APPLICATIONS L T P C
3 0 0 3

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 9

File Systems Organization - Purpose of Database System- Database Characteristics- Views of data - Data Models – Types of Data Models – Database System Architecture - Components of DBMS - Codd's Rule - Entity-Relationship Model- ER to Relational Mapping

UNIT II DATABASE DESIGN 9

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 9

Introduction to SQL – DDL - DML - Data Constraints- Integrity Constraints - Advanced SQL - Views - Functions and Procedures- Triggers - Database Security

UNIT IV INFORMATION RETRIEVAL CONCEPTS 9

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 9

Temporal Database Concepts- Spatial Database Concepts – Spatiotemporal Database Concepts– Obstacle Database – Moving Object Database – Sensor Data Storage – TinyDB – Distributed Database Platform – Hadoop - NO SQL Databases – Hive, Hbase, Mongodb – Database Reports – Data Visualization – Business Intelligence Reporting Tool - BIRT - Case Study

TOTAL: 45 PERIODS

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:

1. Abraham Silberschatz, Henry F. Korth, S. Sudharshan, —Database System Concepts, Sixth Edition, Tata McGraw Hill, 2010.
2. Ramez Elmasri, Shamkant B. Navathe, —Fundamentals of Database Systems, Sixth Edition, Pearson/Addison - Wesley, 2010.

REFERENCES:

1. C.J. Date, A. Kannan and S. Swamynathan, —An Introduction to Database Systems, Pearson Education, Eighth Edition, 2006.
2. Raghu Ramakrishnan, —Database Management Systems, Fourth Edition, McGraw Hill, 2015.
3. Narain Gehani and Melliyal Annamalai. —The Database Book Principles and Practice Using the Oracle Database System, Universities Press, 2012.
4. Ricardo Baeza – Yates, BerthierRibeiro – Neto, Modern Information Retrieval: The concepts and Technology behind Search (ACM Press Books), Second Edition 2011.

5. Christopher D. Manning, Prabhakar Raghavan, Hinrich Schutze, Introduction to Information Retrieval, Cambridge University Press, First South Asian Edition 2012.

EC7593 INTELLIGENT ROBOTIC SYSTEMS L T P C
3 0 0 3

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 9

Artificial Intelligence and Robots - Sensing and Effecting - Knowledge About the Environment- Interpreting - Generating- Reasoning- Sensors - Visual Sensors - Tactile Sensors - Range Sensors -Proprioceptors - Machine Vision - Manipulators - Legs - Arms - Hands - Manipulation.

UNIT II ARTIFICIAL INTELLIGENCE FOR SMART ROBOTS 9

The Basic Elements of Artificial Intelligence - Knowledge Representation - Computational Logic - Logical Inference - Common Sense Reasoning - Non-Deductive Problem Solving Approaches - Languages, Tools and Computers - Applications of Artificial Intelligence.

UNIT III SMART ROBOTS 9

Smart Robots - Overview - Productivity - Impact on Work Force - Growth Potential - System Elements - Controller - Manipulator - End Effector - Robotic Functional Categories - Sensory Perception - Smart Robot Systems - Application of Smart Robots - Implementation of Smart Robots into Your Plant.

UNIT IV PROGRAMMING AND SIMULATION OF INTELLIGENT ROBOTIC SYSTEMS 9

Virtual Robotic Cells - Logical Model of the Robotic Cell - Geometrical Model of the Robotic Cell - Basic Methods of Computational Geometry - Planning of Robotic Cell Actions -Task Specification - Methods for Planning Robotic Cell Actions - Production Routes - Fundamental Plans of Action.

UNIT V PLANNING OF ROBOT MOTION 9

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
- Asses the appropriate sensors for the robotic functions
- Evaluate the program the robot for typical applications

TEXT BOOKS:

1. V. Daniel Hunt, "Smart Robots - A Handbook of Intelligent Robotic Systems", 1st Edition, Chapman and Hall Ltd, 1985.
2. Witold Jacak, "Intelligent Robotic Systems - Design, Planning, And Control", Kluwer Academic Publishers, 2002.664

REFERENCES:

1. Deb. S.R.,“Robotics Technology and flexible Automation”, John Wiley, USA 1992.
2. Klafter R.D., Chimielewski T.A., Negin M., “Robotic Engineering – An integrated approach”, Prentice Hall of India, New Delhi, 1994.
3. Mc Kerrow P.J. “Introduction to Robotics”, Addison Wesley, USA, 1991.
4. Issac Asimov “Robot”, Ballantine Books, New York, 1986.
5. Barry Leatham - Jones, "Elements of industrial Robotics" PITMAN Publishing, 1987.
6. Mikell P.Groover, Mitchell Weiss, Roger N.Nagel Nicholas G.Odrey, "Industrial Robotics Technology, Programming and Applications ", McGraw Hill Book Company 1986.

7. Fu K.S. Gonzaleaz R.C. and Lee C.S.G., "Robotics Control Sensing, Vision and Intelligence", Mc Graw Hill International Editions, 1987.

EC7594 EMBEDDED SYSTEM DESIGN L T P C
3 0 0 3

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 9

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 9

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 9

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 9

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 9

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.

TOTAL: 45 PERIODS

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:

1. Raj Kamal, "Microcontrollers – Architecture, Programming, Interfacing System Design", Dorling Kindersley India Pvt. Ltd., 2012.
2. Raj Kamal, "Embedded Systems- Architecture, Programming and Design", Second Edition, Tata McGraw-Hill Publications, 2008.

REFERENCES:

1. Tim Wilmshurst, "Designing Embedded Systems with PIC microcontrollers-Principles and Applications", Newnes Publications, 2007.
2. Julio Sanchez Maria P.Canton, "Microcontroller Programming: The microchip PIC", CRC Press, Taylor & Francis Group,2007.
3. Martin Bates, "Interfacing PIC microcontrollers-Embedded Design by Interactive Simulation", Newnes Publication, 2006.
4. Muhammad Ali Mazidi, Rolin McKinlay, Danny Causey, "PIC Microcontroller and Embedded Systems: Using Assembly and C for PIC18", Prentice Hall publications, 2007.

IT7593 INTRODUCTION TO INFORMATION TECHNOLOGY ESSENTIALS L T P C
3 0 0 3

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 9

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 9

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 9

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 9

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 9

Cell phone working fundamentals - Cell phone frequencies & channels - Digital cell phone components - Generations of cellular networks - Cell phone network technologies / architecture - Voice calls & SMS

TOTAL: 45 PERIODS

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:

1. Robin Nixon, "Learning PHP, MySQL, JavaScript, CSS & HTML5" Third Edition, O'REILLY, 2014.
2. James F. Kurose, —Computer Networking: A Top-Down Approach, Sixth Edition, Pearson, 2012.

REFERENCES:

1. Gottapu Sasibhushana Rao, "Mobile Cellular Communication", Pearson, 2012
2. R. Kelly Rainer , Casey G. Cegielski , Brad Prince, Introduction to Information Systems, Fifth Edition, Wiley Publication, 2014
3. www.w3schools.com
4. https://www.tutorialspoint.com

IT7594 INTRODUCTION TO CLOUD COMPUTING L T P C
3 0 0 3

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 9

Evolution of Cloud Computing – Need for Cloud Computing – Characteristics of Cloud – Cloud Deployment models – Cloud Service Models – Driving factors and Challenges of Cloud – Cloud Computing Architecture.

UNIT II CLOUD CONCEPTS AND TECHNOLOGIES 9

Virtualization- Load balancing – Scalability & Elasticity – Deployment – Replication- Monitoring- Map Reduce - Identity and Access Management – Service Level Agreements- Billing.

UNIT III CLOUD SERVICES AND PLATFORMS 9

Compute Services – Storage Services – Database Services – Database Services – Application Services - Content Delivery Services – Analytical Services – Deployment and Management services- Identity and Access Management Services.

UNIT IV CLOUD SECURITY 9

Cloud Security Challenges – Authorization- Authentication – Identity & Access Management – Data Security- Data Integrity – Encryption and Key Management.

UNIT V APPLICATIONS OF CLOUD COMPUTING 9

Applications of cloud computing in Healthcare, Energy, Industry and Education. Case Studies.

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:

1. Toby Velte, Anthony Velte, Robert Elsenpenter, “Cloud Computing : A Practical Approach”, Tata McGraw Hill, 2009.
2. ArshdeepBahga, Vijay Madisetti, “Cloud Computing : A Hands-on Approach”, University Press, 2014.

REFERENCES:

1. Kai Hwang, Geoffry C. Fox, Jack J. Dongarra MK, “ Distribute and Cloud Computing” from Parallel processing to the Internet of Things”, Elsevire, 2012.
2. Raj Kumar Buyya, Christen Vecctiola, TamaraiSelvi, “Mastering Cloud Computing, Foundations and Application Programming”, Elsevire, 2013.