PANIMALAR ENGINEERING COLLEGE

(An Autonomous Institution, Affiliated to Anna University, Chennai)
Bangalore Trunk Road, Varadharajapuram,
Poonamallee, Chennai – 600 123.

Department of Mechanical Engineering
B.E- Mechanical Engineering

CURRICULUM AND SYLLABUS

REGULATION-2021

B.E- Mechanical Engineering
CHOICE BASED CREDIT SYSTEM
OPEN ELECTIVES

S.NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	21GE1001	Disaster Management	OE	3	3	0	0	3
2.	21GE1006	Intellectual Property Rights	OE	3	3	0	0	3
3.	21ME1001	Energy Auditing	OE	3	3	0	0	3
4.	21ME1002	Lean Six Sigma	OE	3	3	0	0	3
5.	21ME1003	Sensors for Automation	OE	3	3	0	0	3
6.	21ME1004	Industrial Pollution and Prevention	OE	3	3	0	0	3
7.	21ME1005	Hospital Management	OE	3	3	0	0	3
8.	21ME1006	Systems Engineering	OE	3	3	0	0	3
9.	21ME1007	Marketing Management	OE	3	3	0	0	3
10.	21AD1001	Fundamentals of Artificial Intelligence	OE	3	3	0	0	3
11.	21AD1002	Principle of Machine Learning	OE	3	3	0	0	3
12.	21CS1003	Cloud computing	OE	3	3	0	0	3
13.	21EE1004	Micro Electro Mechanical Systems	OE	3	3	0	0	3

21GE1001	DISASTER MANAGEMENT	L	T	P	C
		3	0	0	3

OBJECTIVES:
- To provide students an exposure to disasters, their significance and types.
- To ensure that students begin to understand the relationship between vulnerability, disasters, disaster prevention and risk reduction
- To gain a preliminary understanding of approaches of Disaster Risk Reduction (DRR)
- To enhance awareness of institutional processes in the country and
- To develop rudimentary ability to respond to their surroundings with potential disaster response in areas where they live, with due sensitivity

UNIT I   INTRODUCTION TODISASTERS   9

Definition: Disaster, Hazard, Vulnerability, Resilience, Risks ― Disasters: Types of disasters ―Earthquake, Landslide, Flood, Drought, Fire etc -Classification, Causes, Impacts including social, economic, political, environmental, health, psychosocial, etc.- Differential impacts- in terms of caste, class, gender, age, location, disability - Global trends in disasters: urban disasters, pandemics,complexemergencies,Climatechange-DosandDon'tsduringvarioustypesofDisasters.

UNIT II   APPROACHES TO DISASTER RISK REDUCTION (DRR)   9

Disaster cycle - Phases, Culture of safety, prevention, mitigation and preparedness community based DRR, Structural- nonstructural measures, Roles and responsibilities of- community, Panchayati Raj Institutions / Urban Local Bodies (PRIs/ULBs), States, Centre, and other stake-holders
InstitutionalProcessessandFrameworkatStateandCentralLevelStateDisasterManagement Authority(SDMA)―EarlyWarningSystem―AdvisoriesfromAppropriateAgencies.

UNIT - III   INTER-RELATIONSHIP BETWEEN DISASTER S AND   9
DEVELOPMENT

Factors affecting Vulnerabilities, differential impacts, impact of Development projects such as dams, embankments, changes in Land-use etc.- Climate Change Adaptation- IPCC Scenario and Scenariosin the context of India-Relevance of indigenous knowledge, appropriate technology and local resources.

UNIT IV DISASTER RISK MANAGEMENT IN INDIA   9

Hazard and Vulnerability profile of India, Components of Disaster Relief: Water, Food,Sanitation,Shelter,Health,WasteManagement,Institutionalarrangements(Mitigation,Re sponseandPreparedness, Disaster Management Act and Policy -Other related policies, plans, programmes and legislation― Role of GI Sand Information Technology Components in Preparedness, Risk Assessment, Response and Recovery Phases of Disaster–Disaster Damage Assessment

UNIT V DISASTER MANAGEMENT: APPLICATIONS AND CASE STUDIES AND FIELD WORKS 9

Landslide Hazard Zonation: Case Studies, Earthquake Vulnerability Assessment of Buildings and Infrastructure: Case Studies, Drought Assessment: Case Studies, Coastal Flooding: Storm Surge Assessment, Floods: Fluvial and Pluvial Flooding: Case Studies; Forest Fire: Case Studies, Man Made disasters: Case Studies, Space Based Inputs for Disaster Mitigation and Management and field works related to disaster management.

TOTAL: 45 PERIODS

COURSE OUTCOMES:
The students will be able to
  CO1: Differentiate the types of disasters, causes and their impact on environment and society
  CO2: Assess vulnerability and various methods of risk reduction measures as well as mitigation.
  CO3: Draw the hazard and vulnerability profile of India, Scenarious in the Indian context, Disaster damage assessment and management.

TEXTBOOKS:
1. Singhal J.P. "Disaster Management", Laxmi Publications, 2010. ISBN-10: 9380386427 ISBN-13: 978-9380386423
2. Tushar Bhattacharya, "Disaster Science and Management", McGraw Hill India Education Pvt. Ltd., 2012. ISBN-10: 1259007367, ISBN-13**:** 978-1259007361]
3. Gupta Anil K, Sreeja S. Nair. Environmental Knowledge for Disaster Risk Management, NIDM, New Delhi, 2011
4. Kapur Anu Vulnerable India: A Geographical Study of Disasters, IIAS and Sage Publishers, New Delhi, 2010.

REFERENCES:
1. Govt. of India: Disaster Management Act , Government of India, New Delhi, 2005
2. Government of India, National Disaster Management Policy, 2009.

21GE1006	INTELLECTUAL PROPERTY RIGHTS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To acquaint the learners with the basic concepts of Intellectual Property Rights.
- To develop expertise in the learners in IPR related issues and sensitize the learners with the emerging issues in IPR and the rationale for the protection of IPR.

UNIT - I   INTRODUCTION   9

Introduction to IPRs, Basic concepts and need for Intellectual Property – Meaning and practical aspects of Patents, Copyrights, Geographical Indications, IPR in India and Abroad. Nature of Intellectual Property, Industrial Property, technological Research, Inventions and Innovations – Important examples of IPR

UNIT - II   INTELLECTUAL PROPERTY RIGHTS   9

The IPR tool kit, Patents, the patenting process, Patent cooperation treaties: International Treaties and conventions on IPRs: Trade Related Aspects of Intellectual Property Rights Agreement, Patent Cooperation Treaty, Patent Act of India, Patent Amendment Act, Design Act, Trademark Act, Geographical Indication Act.

UNIT - III   INTELLECTUAL PROPERTY PROTECTIONS   9

IPR of Living Species, protecting inventions in biotechnology, protections of traditional knowledge, biopiracy and documenting traditional knowledge, Digital Innovations and Developments as Knowledge Assets – IP Laws, Cyber Law and Digital Content Protection. Case studies: The basmati rice issue, revocations of turmeric patent, revocation of neem patent.

**UNIT - IV   EXERCISING AND ENFORCING OF INTELLECTUAL PROPERTY   9
                RIGHTS**

Rights of an IPR owner, licensing agreements, criteria for patent infringement. Case studies of patent infringement, IPR – contract, unfair competitions and control, provisions in TRIPS,

**UNIT - V   ROLE OF PATENTS IN PRODUCT DEVELOPMENT &   9
               COMMERCIALIZATION**

Recent changes in IPR laws impacting patents and copy rights, intellectual cooperation in the science and allied industry. Patentable and non-patentable research. Case studies

TOTAL :   45 PERIODS

COURSE OUTCOME(S):

Upon completion of the course, students will be able to

CO1:   Gain the knowledge of Intellectual Property and its protection through various laws
CO2:   Apply the knowledge of IPR for professional development
CO3:   Develop a platform for protection and compliance of Intellectual Property Rights &
        knowledge
CO4:   Create awareness amidst academia and industry of IPR and Copyright compliance
CO5:   Deliver the purpose and function of IPR and patenting

TEXT BOOKS

1. Nithyananda, K V. (2019). Intellectual Property Rights: Protection and Management. India, IN: Cengage Learning India Private Limited.

2. V. Scople Vinod, Managing Intellectual Property, Prentice Hall of India pvt Ltd, 2012.
3. Fundamentals of lP for Engineers: K.Bansl & P.Bansa

REFERENCE BOOKS

1. Ahuja, V K. Law relating to Intellectual Property Rights. India, IN: Lexis Nexis, 2017.
2. Prabuddha Ganguli,"Intellectual Property Rights: Unleashing the Knowledge Economy", McGraw Hill Education, 2011.
3. Neeraj, P., & Khusdeep, D. Intellectual Property Rights. India, IN: PHI learning Private Limited, 2014.
4. Edited by Derek Bosworth and Elizabeth Webster, The Management of Intellectual Property, Edward Elgar Publishing Ltd., 2013.

WEB REFERENCES

1. Intellectual Property Rights and Development Policy: Report of the Commission on Intellectual Property Rights, London September 2002.
2. WIPO Intellectual Property Handbook. Policy, Law and Us.
3. Subramanian, N., & Sundararaman, M. (2018). Intellectual Property Rights – An Overview. Retrieved from http://www.bdu.ac.in/cells/ipr/docs/ipr-eng-ebook.pdf
4. Cell for IPR Promotion and Management (http://cipam.gov.in/) .
5. Office of the Controller General of Patents, Designs & Trademarks (http://www.ipindia.nic.in/).

ONLINE COURSES / RESOURCES:

1. NPTEL Resource: Intellectual Property Rights (https://nptel.ac.in/courses/109106137)
2. Coursera Resource: Introduction to Intellectual Property (https://www.coursera.org/learn/introduction-intellectual-property)
3. Coursera Resource: Intellectual Property Law (https://www.coursera.org/specializations/introduction-intellectual-property)
4. Udemy Resource: Everything About Industrial Property Rights (https://www.udemy.com/course/everything-about-ipr-intellectual-property-rights/)

21ME1001	ENERGY AUDITING	L	T	P	C
		3	0	0	3

Course Objectives: The course should enable the students to:

- To outline the principles and objectives of energy management.
- To Illustrate the techniques, procedures, evaluation and energy audit reporting.
- To devise energy policy planning and implementation.
- To analyse energy balance sheet and management information System.

UNIT I GENERAL ASPECTS   9

General philosophy: Need of energy audit and management, definition and objective of energy management, general principles of energy management, energy management skills, energy management strategy; Energy audit: need, types, methodology and approach, energy management approach, understanding energy costs, bench marking, energy performance

UNIT II PROCEDURES AND TECHNIQUES, EVALUATION OF SAVING OPPORTUNITIES AND ENERGY AUDIT REPORTING   12

Data gathering: Level of responsibilities, energy sources, control of energy and uses of energy, facts, figures and impression about energy / fuel and system operations, past and present operating data, special tests, questionnaire for data gathering; Techniques: Incremental cost concept, mass and energy balancing techniques, inventory of energy inputs and rejections; Evaluations: Heat transfer calculations, evaluation of electric load characteristics, process and energy system simulation

UNIT III   ENERGY POLICY PLANNING AND IMPLEMENTATION   8

Policy planning: Force field analysis, energy policy purpose, perspective, contents and formulation, location of energy manager, top management support, managerial functions, role and responsibilities of energy manager, accountability. Motivating: Motivation of employees, requirements for energy action planning; Implementation: Designing, barriers, strategies, marketing and communicating training and planning

UNIT IV   ENERGY BALANCE AND MIS   8

Energy balance: First law of efficiency and second law of efficiency, facility as an energy system, methods for preparing process flow, materials and energy balance diagram, identification of losses, improvements; MIS: Energy balance sheet and management information system (MIS) energy modelling and optimization

UNIT V   ENERGY AUDIT INSTRUMENTS   8

Instruments: Instruments for audit and monitoring energy and energy savings, types and accuracy.

TOTAL: 45 PERIODS

COURSE OUTCOME(S):

Upon completion of the course, students will be able to

CO1: Conceptual knowledge of the need and approach of energy audit and management
CO2: Capability to integrate various options and assess the business and policy environment regarding energy conservation and energy auditing
CO3: Advocacy of strategic and policy recommendations on energy conservation and energy auditing
CO4: Knowledge of energy balance and information management

CO5:   Discuss the instruments required for energy auditing

TEXT BOOKS

1. W R Murphy, G Mckay, "Energy Management", Butterworths, 2nd Edition, 2009.
2. C B Smith, "Energy Management Principles", Pergamon Press, 2nd Edition, 1981
3. I G C Dryden, "Efficient Use of Energy", Butterworths, 1st Edition, 1982.
4. AV Desai, "Energy Economics" , Wiley Eastern, 1st Edition, 1991.

REFERENCES:

1. D A Reay, "Industrial Energy Conservation", Pergammon Press, 1st Edition, 1977.
2. W C Turner, " Energy Management Handbook, John Wiley and Sons, 6th Edition , 2006.
3. L C Witte, P S Schmidt, D R Brown, "Industrial Energy Management and Utilization",.Hemisphere Publication, Washington, 1st Edition, 1988.

WEB REFERENCES

1. https://www.beeindia.gov.in/content/energy-auditors
2. https://www.cpri.in ›energy efficiency and renewable energy division (ered)
3. https://www.michigan.gov/documents/cis_eo_inside_churchmanual_45636_7.

ONLINE COURSES / RESOURCES:

1. https://www.bookstore.teri.res.in/books/9788179930922
2. https://www.sjbit.edu.in/.../eee/.../energy%20auditing%20&%20demand%20side%20

21ME1002	LEAN SIX SIGMA	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To explain the basics of Lean and Six Sigma.
- To teach the need and the process of integrating Lean and Six sigma.
- To identify and select the resources required for LSS Projects and selection of projects including Team building.
- To teach the DMAIC process and study the various tools for undertaking LSS projects.
- To Illustrate to institutionalize the LSS efforts.

UNIT I   INTRODUCTION TO LEAN AND SIX SIGMA   9

Introduction to Lean- Definition, Purpose, Features of Lean ; Top seven wastes, Need for Lean management, The philosophy of lean management, Creating a lean enterprise, Elements of Lean, Lean principles, the lean metric, Hidden time traps. Introduction to quality, Definition of six sigma, origin of six sigma, Six sigma concept and Critical success factors for six sigma.

UNIT II   INTEGRATION OF LEAN AND SIX SIGMA   9

Evolution of lean six sigma, the synergy of Lean and six sigma, Definition of lean six sigma, the principles of lean six sigma, Scope for lean six sigma, Features of lean six sigma. The laws of lean six sigma, Key elements of LSS, the LSS model and the benefits of lean six sigma. Initiation - Top management commitment – Infrastructure and deployment planning, Process focus, organizational structures, Measures – Rewards and recognition, Infrastructure tools, structure of transforming event and Launch preparation

UNIT III   PROJECT SELECTION AND TEAM BUILDING   9

Resource and project selection, Selection of Black belts, Training of Black belts and Champions, Identification of potential projects, top down (Balanced score card) and Bottom up approach – Methods of selecting projects – Benefit/Effort graph, Process mapping, value stream mapping, Predicting and improving team performance, Nine team roles and Team leadership

UNIT IV   THE DMAIC PROCESS AND TOOLS   9

The DMAIC process – Toll gate reviews; The DMAIC tools; Define tools – Project definition form, SIPOC diagram; Measure tools – Process mapping, Lead time/cycle time, Cause and Effect matrix, Idea – generating and organizing tools – Brainstorming, Nominal group technique and Multi-voting; Data collection and accuracy tools- Check sheet, Gauge R&R; Understanding and eliminating variation- run charts; Analyze tools - Scatter plots, ANOVA, Regression analysis, Time trap analysis; Improve tools – Mistake proofing, Set up time reduction (SMED) and the pull system; Control tools – statistical process control

UNIT V   INSTITUTIONALIZING AND DESIGN FOR LSS   9

Institutionalizing lean six sigma – improving design velocity, creating cycle time base line, valuing projects, gating the projects, reducing product line complexity, Design for lean six sigma, QFD, Theory of Inventive Problem solving (TRIZ), Robust design; Case study presentations

TOTAL :   45 PERIODS

COURSE OUTCOME(S):

Upon completion of the course, students will be able to

CO1:   Able to understand what is Lean and Six sigma and their importance in the globalized

competitive world..

CO2: Able to understand the importance of integrating Lean and Six sigma and also the process of their integration

CO3: Able to plan the Resources required to undertake the LSS projects and also acquire how to select the suitable projects and the teams.

CO4: Apply DMAIC methodology to execute LSS projects and in this regard they will be acquainted with various LSS tools

CO5: Able to understand the process of institutionalizing the LSS effort and also understand the Design for LSS

TEXT BOOKS

1. Michael L. George, Lean Six Sigma, McGraw-Hill., 2002 .
2. Thomas Pyzdek, Paul Keller "The Six Sigma Handbook", 3rd Edition, McGraw-Hill., 2009

REFERENCE BOOKS

1. James P. Womack, Daniel T. Jones, Lean Thinking, Free press business., 2003.
2. Ronald G.Askin and Jeffrey B.Goldberg, Design and Analysis of Lean Production Systems, John Wiley &Sons., 2003.
3. Salman Taghizadegan, Essentials of Lean Six Sigma, Elsevier., 2010.

WEB REFERENCES

1. https://www.mtcbh.net/mt-content/uploads/2017/01/6-sigma-handnbook.pdf
2. https://aalssc.org/wp-content/uploads/2017/10/AALSSCstudyguide-Green2018.pdf
3. https://www.researchgate.net/publication/331648936_Six_Sigma_Approach_in_Material_Management
4. https://www.sciencedirect.com/science/article/abs/pii/S0009912022002661

ONLINE COURSES / RESOURCES:

1. https://www.youtube.com/watch?v=iEM0df_0-0o
2. https://www.youtube.com/watch?v=2ePeXePNLrs
3. https://www.youtube.com/watch?v=sd2xKiG8nnw

21ME1003	SENSORS FOR AUTOMATION	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To learn the various types of sensors, transducers and signal conditioning circuits
- essential for industrial automation.
- To understand the working principles and applications of resistance, inductance and capacitance transducers.
- To understand the various types of piezoelectric and magnetic sensors.
- To impart knowledge on chemical and radiation sensors.
- To understand the real time usage of various modern sensor.
- To understand the real time application of sensors in the field of Automobile Engineering, Aeronautics, Machine tools and Manufacturing processes with case studies

UNIT - I   INTRODUCTION   9

Definition, Measurement Techniques, Classification of errors, Error analysis, Static and dynamic characteristics of transducers, Performance measures of sensors, Classification of sensors, calibration techniques.

UNIT - II   RESISTANCE, INDUCTANCE AND CAPACITANCE   9
**   TRANSDUCERS**

Potentiometer, strain gauges, optical encoders, LVDT, RVDT, Synchro, Microsyn, Applications: Pressure, position, angle and acceleration. Capacitance circuitry, Feedback type condenser microphone , frequency modulating oscillator circuit, Dynamic capacitance variation, A.C. Bridge for Amplitude Modulation, Applications: Proximity, microphone, pressure, displacement.

UNIT - III   PIEZOELECTRIC & MAGNETIC SENSORS   9

Piezoelectric Materials and properties, Modes of deformation, Multimorphs, Environmental effects, Applications: Accelerometer, ultrasonic. Magnetic Sensors, types, principle, requirement and advantages: Magneto resistive, Hall Effect – Eddy current.

UNIT - IV   RADIATION AND ELECTRO CHEMICAL SENSORS   9

Photo conductive cell, photo voltaic, Photo resistive, Fiber optic sensors, Ray and Nuclear radiation sensors, Electro chemical sensors: Electro chemical cell, Polarization, sensor Electrodes and Electro-ceramics in Gas Media.

UNIT - V   MODERN SENSORS AND CASE STUDIES   9

Film sensors, micro-scale sensors, Particle measuring systems, Vibration Sensors, SMART sensors, Machine Vision, Multi-sensor systems Case studies of Sensors in Automobile Engineering, Aeronautics, Machine tools and Manufacturing processes..

TOTAL :   45 PERIODS

COURSE OUTCOME(S):

Upon completion of the course, students will be able to

CO1:   Understand the various types of sensors, transducers and signal conditioning circuits essential for industrial automation.

CO2:   Understand the working principles and applications of resistance, inductance and capacitance transducers.

CO3:   Understand the various types of piezoelectric and magnetic sensors.
CO4:   Acquire knowledge on various chemical and radiation sensors.
CO5:   Understand the real time usage of various modern sensor.

TEXT BOOKS

1. Renganathan S.," Transducer Engineering", Allied Publishers (P) Ltd., 2003.

REFERENCE BOOKS

1. Bolton W, "Mechatronics", Thomson Press, 2019.
2. Bradley D.A., and Dawson, Burd and Loader, "Mechatronics", Thomson Press India Ltd", 2004.
3. Ernest O. Doebelin, "Measurement systems Application and Design", International Student Edition, VII Edition, Tata McGraw-Hill Book Company, 2019.
4. Ghosh A K, "Introduction to Measurements and Instrumentation", Fourth Edition, PHI Learning, 2012
5. Patranabis D., "Sensor and Actuators", Prentice Hall of India (Pvt) Ltd., 2005. WEB

WEB REFERENCES

1. https://www.youtube.com/watch?v=U2XepZNbWi8
2. https://www.youtube.com/watch?v=qKAhSBmte1c
3. https://www.youtube.com/watch?v=n1XcDq-Ynv0
4. https://www.youtube.com/watch?v=b2KRO6rxqeY

ONLINE COURSES / RESOURCES:
1. https://nptel.ac.in/courses/108/108/108108147/
2. https://www.udemy.com/course/sensors-sensor-fundamentals/
3. https://drive.google.com/file/d/1V6euylgrC_TcQ8pVyMRtxg0CRX7OYzJu/view

21ME1004	INDUSTRIAL POLLUTION AND PREVENTION	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To learn a variety of chemical, physical, biological treatment processes related to industrial pollution control.
- To make pollution profiles of the industries, categorization, control methodologies and technologies, system design, ethic concepts and solving of the engineering problems on industrial systems.

UNIT - I   TYPES OF POLLUTION   9

Types of emissions from chemical industries and effects of environment, environment legislation, Type of pollution, sources of wastewater, Effluent guidelines and standards

UNIT - II   CHARACTERISTICS OF POLLUTANTS   9

Characterization of effluent streams, oxygen demands and their determination (BOD, COD, and TOC), Oxygen sag curve, BOD curve mathematical, controlling of BOD curve, self purification of running streams, sources and characteristics of pollutants in fertilizer, paper and pulp industry. General methods of control and removal of sulfur dioxide, oxides of nitrogen and organic vapors from gaseous effluent, treatment of liquid and gaseous effluent in fertilizer industry.

UNIT - III   CONTROL OF POLLUTION   9

General methods of control and removal of sulfur dioxide, oxides of nitrogen and organic vapors from gaseous effluent, treatment of liquid and gaseous effluent in fertilizer industry.

UNIT - IV   POLLUTION MEASUREMENTS   9

Air pollution sampling and measurement: Types of pollutant and sampling and measurement, ambient air sampling: collection of gaseous air pollutants, collection of particulate air pollutants. Stack sampling: sampling system, particulate sampling, and gaseous sampling. Analysis of air pollutants: Sulphur dioxide, nitrogen oxides, carbon monoxide, oxidants and Ozone, hydrocarbons, particulate matter.

UNIT - V   EMISSION CONTROL TECHNIQUES   9

Air pollution control methods and equipments: Source collection methods: raw material changes, process changes, and equipment modification. Cleaning of gaseous equipments particulate emission control: collection efficiency, control equipment like gravitational settling chambers, Cyclone separators, fabric filters, scrubbers, packed beds and plate columns, venturi scrubbers, their design aspects. Control of gaseous emissions: absorption by liquids, absorption equipments, adsorption by solids

TOTAL :   45 PERIODS

COURSE OUTCOME(S):

Upon completion of the course, students will be able to
CO1:   Understanding of air/water pollution regulations and their scientific basis.
CO2:   Apply knowledge for the protection and improvement of the environment
CO3:   Understanding the sources and characteristics of the pollutants.
CO4:   Ability to monitor and design the air and water pollution control systems.
CO5:   Ability to select and use suitable waste treatment technique.
        .

TEXT BOOKS

1. Environmental pollution and control engineering, Rao C. S. - Wiley Eastern Limited, India, 1993.
2. Pollution control in process industries by S.P. Mahajan TMH.,1985.

REFERENCE BOOKS

1. Waste water treatment by M.Narayana Rao and A.K.Datta,Oxford and IHB publ. New Delhi.
2. Air pollution control by P.Prathap mouli and N.Venkata subbayya. Divya Jyothi Prakashan, Jodhpur.
3. "Industrial Pollution Control and Engineering." Swamy AVN, Galgotia publications, 2005.Hyderabad

WEB REFERENCES

1. https://www.oecd.org/env/ehs/risk-management/best-available-techniques.htm

ONLINE COURSES / RESOURCES:
1. https://onlinecourses.nptel.ac.in/noc22_ce22/preview

21ME1005	HOSPITAL MANAGEMENT	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the fundamentals of hospital administration and management.
- To know the market related research process
- To explore various information management systems and relative supportive services
- To learn the quality and safety aspects in hospital.

UNIT I   OVERVIEW OF HOSPITAL ADMINISTRATION   **9**

Distinction between Hospital and Industry, Challenges in Hospital Administration – Hospital Planning- Equipment Planning – Functional Planning

UNIT II   HUMAN RESOURCE MANAGEMENT IN HOSPITAL   **9**

Principles of HRM – Functions of HRM – Profile of HRD Manager –Human Resource Inventory – Manpower Planning

UNIT III   RECRUITMENT AND TRAINING   **9**

Different Departments of Hospital, Recruitment, Selection, Training Guidelines – Methods of Training – Evaluation of Training – Leadership grooming and Training, Promotion – Transfer

UNIT IV   SUPPORTIVE SERVICES   **9**

Medical Records Department – Central Sterilization and Supply Department – Pharmacy – Food Services - Laundry Services.

UNIT V   COMMUNICATION AND SAFETY ASPECTS IN HOSPITAL   **9**

Purposes – Planning of Communication, Modes of Communication – Telephone, ISDN, Public Address and Piped Music – CCTV. Security – Loss Prevention – Fire Safety – Alarm System – Safety Rules

TOTAL :   45 PERIODS

COURSE OUTCOME(S):

Upon completion of the course, students will be able to

CO1:   Understand fundamentals of hospital administration and management and their importance in the globalized competitive world..

CO2:   Understand the market related research process

CO3:   Explore various information management systems and relative supportive services.

CO4:   Apply the quality and safety aspects in hospital

CO5:   Understand the communication and safety aspects in hospital

TEXT BOOKS

1. R.C.Goyal, "Hospital Administration and Human Resource Management", PHI – Fourth Edition, 2006.
2. G.D.Kunders, "Hospitals – Facilities Planning and Management – TMH, New Delhi – Fifth Reprint 2007.

REFERENCE BOOKS

1. Cesar A.Caceres and Albert Zara, "The Practice of Clinical Engineering, Academic Press, New York, 1977.
2. Norman Metzger, "Handbook of Health Care Human Resources Management", 2nd edition, Aspen Publication Inc. Rockville, Maryland, USA, 1990.

3. Peter Berman "Health Sector Reform in Developing Countries" - Harvard University Press, 1995.
4. William A. Reinke "Health Planning For Effective Management" - Oxford University Press.1988
5. Blane, David, Brunner, "Health and SOCIAL Organization: Towards a Health Policy for the 21st Century", Eric Calrendon Press 2002.
6. Arnold D. Kalcizony& Stephen M. Shortell, "Health Care Management", 6th Edition Cengage Learning, 2011.

WEB REFERENCES

1. https://www.karexpert.com/blogs/what-is-hospital-management-system/
2. https://mocdoc.in/blog/a-detailed-view-of-hospital-management-system-hms
3. https://www.leadsquared.com/hospital-management-system-hms/
4. https://gloriumtech.com/hospital-management-software-development-key-features-and-benefits/

ONLINE COURSES / RESOURCES:

1. https://youtu.be/QDnU1q64vvw
2. https://youtu.be/EnN6zQ0fbBk
3. https://youtu.be/r6TfQtHvqX4
4. https://youtu.be/VS4olM_Y7aI

21ME1006	SYSTEMS ENGINEERING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To Illustrate the life cycle phases and framework for systems engineering.
- To describe about systems engineering process.
- To apply ergonomic and system dynamic models for evaluation of alternatives.
- To create knowledge on Reliability, Markov and Time series models for analysis of alternatives.
- To describe about decision assessment methods in systems engineering.

UNIT I   **INTRODUCTION**   **9**

Definitions of Systems Engineering, Systems Engineering Knowledge, Life cycles, Life-cycle phases, logical steps of systems engineering, Frame works for systems engineering.

UNIT II   **SYSTEMS ENGINEERING PROCESSES**   **9**

Formulation of issues with a case study, Value system design, Functional analysis, Business Process Reengineering, Quality function deployment, System synthesis, Approaches for generation of alternatives.

UNIT III   **ANALYSIS OF ALTERNATIVES - I**   **9**

Cross-impact analysis, Structural modeling tools, System Dynamics models with case studies, Economic models: present value analysis – NPV, Benefits and costs over time, ROI, IRR; Work and Cost breakdown structure.

UNIT IV   **ANALYSIS OF ALTERNATIVES – II**   **9**

Reliability, Availability, Maintainability, and Supportability models; Stochastic networks and Markov models, Queuing network optimization, Time series and Regression models, Evaluation of large scale models

UNIT V   **DECISION ASSESSMENT**   **9**

Decision assessment types, Five types of decision assessment efforts, Utility theory, Group decision making and Voting approaches, Social welfare function; Systems Engineering methods for Systems Engineering Management

TOTAL : 45 PERIODS

COURSE OUTCOME(S):

Upon completion of the course, students will be able to

CO1:   Be able to recognize life cycle phases in systems engineering.
CO2:   Apply steps in systems engineering process for large scale problems.
CO3:   Able to develop system dynamic models for analyzing alternatives.
CO4:   Gain ability to evaluate alternatives in large scale problems.
CO5:   Be able Attain confidence in assessment and arrive decisions for complex problems.

TEXT BOOKS

1. Andrew P. Sage, James E. Armstrong Jr. "Introduction to Systems Engineering", John Wiley and Sons, Inc, 2000.
2. Alexander Kossiakoff, Steven M. Biemer, Samuel J. Seymour, David A. Flanigan "Systems Engineering Principles and Practice", 3rd Edition

REFERENCE BOOKS

1. Andrew P.Sage, "Systems Engineering", John Wiley & Sons, 1992.
2. Andrew P.Sage, William B.Rouse, "Hand book of Systems Engineering and Management", John Wiley & Sons, 1999.

WEB REFERENCES

1. https://user.eng.umd.edu/~austin/enes489p/lecture-slides/2012-MA-Introduction-to-SE.pdf
2. https://www.sebokwiki.org/w/images/SEBoK%20v.%201.9.1.pdf
3. https://www.researchgate.net/publication/273457341_Systems_engineering_evolution_and_challenges
4. https://freecomputerbooks.com/Systems-Engineering-Practice-and-Theory.html

ONLINE COURSES / RESOURCES:

1. https://user.eng.umd.edu/~austin/enes489p/lecture-slides/2012-MA-Introduction-to-SE.pdf
2. https://www.sebokwiki.org/w/images/SEBoK%20v.%201.9.1.pdf
3. https://www.researchgate.net/publication/273457341_Systems_engineering_evolution_and_challenges
4. https://freecomputerbooks.com/Systems-Engineering-Practice-and-Theory.html

21ME1007	MARKETING MANAGEMENT	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To enable students to deal with newer concepts of marketing concepts like strategic marketing segmentation, pricing, advertisement, and strategic formulation.
- The course will enable a student to take up marketing as a professional career.

Unit I   **MARKETING PROCESS**   **9**

Definition, Marketing process, dynamics, needs, wants and demands, marketing concepts, environment, mix, types. Philosophies, selling versus marketing, organizations, industrial versus consumer marketing, consumer goods, industrial goods, product hierarchy

Unit II   **BUYING BEHAVIOUR AND MARKET SEGMENTATION**   **9**

Cultural, demographic factors, motives, types, buying decisions, segmentation factors - demographic -Psycho graphic and geographic segmentation, process, patterns.

Unit III   **PRODUCT PRICING AND MARKETING RESEARCH**   **9**

Objectives, pricing, decisions and pricing methods, pricing management. Introduction, uses, process of marketing research.

Unit IV   **MARKETING PLANNING AND STRATEGY FORMULATION**   **9**

Components of marketing plan-strategy formulations and the marketing process, implementations, portfolio analysis, BCG, GEC grids.

Unit V   **ADVERTISING, SALES PROMOTION AND DISTRIBUTION**   **9**

Characteristics, impact, goals, types, and sales promotions - point of purchase - unique selling proposition. Characteristics, wholesaling, retailing, channel design, logistics, and modern trends in retailing, Modern Trends, e-Marketing.

TOTAL :   45 PERIODS

COURSE OUTCOME(S):

Upon completion of the course, students will be able to
CO1:   Understand the marketing process and concepts in various product environment
CO2:   Understand the buyer's approach based on various demograhic requirements
CO3:   Understand the product pricing based on process of marketing research
CO4:   Understand the market planning based on various formulated strategies.
CO5:   Enhance the knowledge about Marketer's Practices and
         create insights on Advertising, Branding, Retailing and Marketing Research.

TEXT BOOKS

1. Philip Kolter & Keller, "Marketing Management", Prentice Hall of India, 14th edition, 2012.
2. Chandrasekar. K.S., "Marketing Management Text and Cases", 1st Edition, Tata McGraw Hill – Vijaynicole, 2010.

REFERENCE BOOKS

1. Czinkota & Kotabe, "Marketing management", Thomson learning, Indian edition 2007
2. Adrain palmer, " Introduction to marketing theory and practice", Oxford university press IE 2004
3. Donald S. Tull and Hawkins, "Marketing Research", Prentice Hall of Inida-1997.

4. Philip Kotler and Gary Armstrong "Principles of Marketing" Prentice Hall of India, 2000
5. Steven J.Skinner, "Marketing", All India Publishers and Distributes Ltd. 1998.
6. Graeme Drummond and John Ensor, "Introduction to marketing concepts", Elsevier, Indian Reprint, 2007.

WEB REFERENCES

1. https://www.tandfonline.com/loi/rjmm20
2. https://www.scimagojr.com/journalsearch.php?q=19700187623&tip=sid
3. http://www.jmm-net.com/

ONLINE COURSES / RESOURCES:

1. https://nptel.ac.in/courses/110104068
2. https://nptel.ac.in/courses/110104070
3. https://www.digimat.in/nptel/courses/video/110104068/L01.html
4. https://youtu.be/9WtwH8n-4r8

		L	T	P	C
21AD1001	**FUNDAMENTALS OF ARTIFICIAL INTELLIGENCE**	3	0	0	3

OBJECTIVES:

- Understand the basics of the theory and practice of Artificial Intelligence as a discipline and about intelligent agents.
- Understand search techniques and gaming theory.
- The student will learn to apply knowledge representation techniques and problem solving strategies to common AI applications.
- Student should be aware of techniques used for classification and clustering.
- Student should aware of basics of pattern recognition and steps required for it.

Unit I   INTRODUCTION   9

Introduction–Definition – Future of Artificial Intelligence – Characteristics of Intelligent Agents– Typical Intelligent Agents – Problem Solving Approach to Typical AI problems.

Unit II   PROBLEM SOLVING METHODS   9

Problem solving Methods – Search Strategies- Uninformed – Informed – Heuristics – Local Search Algorithms and Optimization Problems – Searching with Partial Observations – Constraint Satisfaction Problems – Constraint Propagation – Backtracking Search – Game Playing – Optimal Decisions in Games – Alpha – Beta Pruning – Stochastic Games

Unit III   KNOWLEDGE REPRESENTATION   9

First Order Predicate Logic – Prolog Programming – Unification – Forward Chaining- Backward Chaining – Resolution – Knowledge Representation – Ontological Engineering- Categories and Objects – Events – Mental Events and Mental Objects – Reasoning Systems for Categories – Reasoning with Default Information

Unit IV   SOFTWARE AGENTS   9

Architecture for Intelligent Agents – Agent communication – Negotiation and Bargaining – Argumentation among Agents – Trust and Reputation in Multi-agent systems.

Unit V   APPLICATIONS   9

AI applications – Language Models – Information Retrieval- Information Extraction – Natural Language Processing – Machine Translation – Speech Recognition – Robot – Hardware – Perception – Planning – Moving

TOTAL : 45 PERIODS

COURSE OUTCOME(S):

Upon completion of the course, students will be able to
CO1: To learn the fundamentals of natural language processing
CO2: To understand the use of CFG and PCFG in NLP
CO3: To understand the role of semantics of sentences and pragmatic
CO4: To Introduce Speech Production And Related Parameters Of Speech.
CO5: To Show The Computation And Use Of Techniques Such As Short Time Fourier Transform, Linear Predictive Coefficients And Other Coefficients In The Analysis Of Speech.

TEXT BOOKS

1. S. Russell and P. Norvig, "Artificial Intelligence: A Modern Approach‖, Prentice Hall, Third Edition, 2009.
2. Bratko, "Prolog: Programming for Artificial Intelligence", Fourth edition, Addison- Wesley Educational Publishers Inc., 2011.
3. M. Tim Jones, ―Artificial Intelligence: A Systems Approach(Computer Science)‖, Jones and Bartlett Publishers, Inc.First Edition, 2008
4. Nils J. Nilsson, ―The Quest for Artificial Intelligence‖, Cambridge University Press, 2009.
5. William F. Clocksin and Christopher S. Mellish,‖ Programming in Prolog: Using the ISO Standard‖, Fifth Edition, Springer, 2003.
6. Gerhard Weiss, ―Multi Agent Systems‖, Second Edition, MIT Press, 2013.
7. David L. Poole and Alan K. Mackworth, ―Artificial Intelligence: Foundations of Computational Agents‖, Cambridge University Press, 2010.

REFERENCE BOOKS

1. Czinkota & Kotabe, "Marketing management", Thomson learning, Indian edition 2007
2. Adrain palmer, " Introduction to marketing theory and practice", Oxford university press IE 2004
3. Donald S. Tull and Hawkins, "Marketing Research", Prentice Hall of Inida-1997.
4. Philip Kotler and Gary Armstrong "Principles of Marketing" Prentice Hall of India, 2000
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3. http://www.jmm-net.com/

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1. https://nptel.ac.in/courses/110104068
2. https://nptel.ac.in/courses/110104070
3. https://www.digimat.in/nptel/courses/video/110104068/L01.html
4. https://youtu.be/9WtwH8n-4r8

	PRINCIPLE OF MACHINE LEARNING	L	T	P	C
21AD1002		3	0	0	3

OBJECTIVES:

- To understand the basics of Machine Learning
- To understand the Supervised learning methods
- To know about the Ensemble learning methods
- To understand Unsupervised learning methods
- To learn about applications of Machine Learning
- To implement use cases of ML

UNIT I   MACHINE LEARNING BASICS   9

Introduction to Machine Learning (ML) - Essential concepts of ML - Types of learning - Machine learning methods based on Time - Dimensionality - Linearity and Non linearity - Early trends in Machine learning - Data Understanding Representation and visualization.

UNIT II   SUPERVISED LEARNING ALGORITHMS   9

Learning a Class from Examples – Linear - Non-linear - Multi-class and Multi-label classification- Decision Trees - ID3 – Regression - Linear Regression - Multiple Linear Regression - Bayesian Network.

UNIT III   SUPERVISED AND ENSEMBLE LEARNING   9

Neural Networks - Introduction – Perceptron - Multilayer Perceptron, Support vector machines - K-Nearest Neighbors - Bagging: Random Forest Trees - Boosting: Adaboost

UNIT IV   UNSUPERVISED LEARNING   9

Introduction to clustering – Partitional: K-means clustering - Self-Organizing Map - Expectation Maximization - Principal Component Analysis (PCA) - Fuzzy Modeling - Genetic Modeling.

UNIT V   APPLICATIONS OF MACHINE LEARNING   9

Image Recognition – Speech Recognition – Email spam and Malware Filtering – Online fraud detection – Medical Diagnosis.

TOTAL :   45 PERIODS

COURSE OUTCOME(S):

Upon completion of the course, students will be able to

CO1:   Understand the basics of ML
CO2:   Apply various supervised learning methods to appropriate problems.
CO3:   Identify and integrate more than one technique to enhance the performance of learning.
CO4:   To Create unsupervised learning models for handling unknown pattern.
CO5:   Apply machine learning algorithms for variety of applications

TEXT BOOKS

1. Ameet V Joshi, Machine Learning and Artificial Intelligence, Springer Publications, 2020. (UNIT 1)
2. Ethem Alpaydin,"Introduction to Machine Learning”, MIT Press, Prentice Hall of India, Third Edition 2014. (UNIT 2,3,4,5).

WEB REFERENCES

1. https://www.geeksforgeeks.org/machine-learning/
2. https://www.javatpoint.com/applications-of-machine-learning/

ONLINE COURSES / RESOURCES:

1. https://nptel.ac.in/courses/106106139
2. https://nptel.ac.in/courses/106105152

21CS1003	CLOUD COMPUTING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To learn about the concept of cloud and utility computing.
- To have knowledge on the various issues in cloud computing.
- To be familiar with the lead players in cloud.
- To appreciate the emergence of cloud as the next generation computing paradigm.

UNIT - I   INTRODUCTION TO CLOUD COMPUTING   9

Introduction to Cloud Computing – Roots of Cloud Computing – Desired Features of Cloud Computing – Challenges and Risks – Benefits and Disadvantages of Cloud Computing.

UNIT - II   VIRTUALIZATION   9

Introduction to Virtualization Technology – Load Balancing and Virtualization – Understanding Hypervisor – Types of Virtualization – Server, Desktop, Application Virtualization.

UNIT - III   CLOUD ARCHITECTURE, SERVICES AND STORAGE   9

NIST Cloud Computing Reference Architecture – Public, Private and Hybrid Clouds - IaaS – PaaS – SaaS – Architectural Design Challenges.

UNIT - IV   RESOURCE MANAGEMENT AND SECURITY IN CLOUD   9

Inter Cloud Resource Management – Resource Provisioning Methods – Security Overview – Cloud Security Challenges – Data Security –Application Security – Virtual Machine Security.

UNIT - V   CASE STUDIES   9

Google App Engine(GAE) – GAE Architecture – Functional Modules of GAE – Amazon Web Services(AWS) – GAE-Open Stack .

TOTAL :   45 PERIODS

COURSE OUTCOME(S):

Upon completion of the course, students will be able to

CO1:   Articulate the main concepts, key technologies, strengths and limitations of cloud computing.

CO2:   Learn the key and enabling technologies that help in the development of cloud.

CO3:   Develop the ability to understand and use the architecture of compute and storage cloud, service and delivery models.

CO4:   Explain the core issues of cloud computing such as resource management and security.

CO5:   Choose the appropriate technologies, algorithms and approaches for implementation and use of cloud.

TEXT BOOKS

1. Buyya R., Broberg J., Goscinski A., Cloud Computing: Principles and Paradigm, First Edition, John Wiley and Sons, 2011.
2. Kai Hwang, Geoffrey C. Fox, Jack G. Dongarra, "Distributed and Cloud Computing, From Parallel Processing to the Internet of Things", Morgan Kaufmann Publishers, 2012.
3. Rittinghouse, John W., and James F. Ransome, Cloud Computing: Implementation,

Management, And Security, CRC Press, 2017.

REFERENCE BOOKS

1. RajkumarBuyya, Christian Vecchiola, S. ThamaraiSelvi, Mastering Cloud Computing, Tata Mcgraw Hill, 2013.
2. Toby Velte, Anthony Velte, Robert Elsenpeter, "Cloud Computing – A Practical Approach, Tata Mcgraw Hill, 2009.
3. George Reese, "Cloud Application Architectures: Building Applications and Infrastructure in the Cloud: Transactional Systems for EC2 and Beyond (Theory in Practice), OReilly, 2009.

21EE1004	MICRO ELECTRO MECHANICAL SYSTEMS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To provide knowledge of semiconductors and solid mechanics to fabricate MEMS devices
- To educate on the rudiments of Micro fabrication techniques.
- To introduce various sensors and actuators
- To introduce different materials used for MEMS
- To educate on the applications of MEMS to disciplines beyond Electrical and Mechanical engineering.

UNIT - I   INTRODUCTION   9

Intrinsic Characteristics of MEMS – Energy Domains and Transducers- Sensors and Actuators – Introduction to Micro fabrication - Silicon based MEMS processes – New Materials – Review of Electrical and Mechanical concepts in MEMS – Semiconductor devices – Stress and strain analysis – Flexural beam bending- Torsional deflection.

UNIT - II   SENSORS AND ACTUATORS-I   9

Electrostatic sensors – Parallel plate capacitors – Applications – Interdigitated Finger capacitor – Comb drive devices – Micro Grippers – Micro Motors - Thermal Sensing and Actuation – Thermal expansion – Thermal couples – Thermal resistors – Thermal Bimorph - Applications – Magnetic Actuators – Micro-magnetic components – Case studies of MEMS in magnetic actuators- Actuation using Shape Memory Alloys.

UNIT - III   SENSORS AND ACTUATORS-II   9

Piezo-resistive sensors – Piezo-resistive sensor materials - Stress analysis of mechanical elements – Applications to Inertia, Pressure, Tactile and Flow sensors – Piezoelectric sensors and actuators – piezoelectric effects – piezoelectric materials – Applications to Inertia, Acoustic, Tactile and Flow sensors.

UNIT - IV   MICROMACHINING   9

Silicon Anisotropic Etching – Anisotrophic Wet Etching – Dry Etching of Silicon – Plasma Etching – Deep Reaction Ion Etching (DRIE) – Isotropic Wet Etching – Gas Phase Etchants – Case studies - Basic surface micro machining processes – Structural and Sacrificial Materials – Acceleration of sacrificial Etch – Striction and Antistriction methods – LIGA Process - Assembly of 3D MEMS – Foundry process.

UNIT - V   POLYMER AND OPTICAL MEMS   9

Polymers in MEMS– Polimide - SU-8 - Liquid Crystal Polymer (LCP) – PDMS – PMMA – Parylene – Fluorocarbon - Application to Acceleration, Pressure, Flow and Tactile sensors- Optical MEMS – Lenses and Mirrors – Actuators for Active Optical MEMS.

TOTAL: 45 PERIODS

COURSE OUTCOME(S):

Upon completion of the course, students will be able to

CO1: Explain about fabrication processes for producing micro-sensors and actuators.
CO2: Design Micro sensors and actuators actuated by Electrical and Thermal Actuation
CO3: Design Micro sensors and actuators actuated by Piezo-Electric and magnetic Actuation
CO4: Analyse the behavior of MEMS system
CO5: Understand the operation and manufacturing of Microsystems.
CO6: Gain Knowledge on application of MEMS devices.

TEXT BOOKS:

1. Chang Liu, 'Foundations of MEMS', Pearson Education Inc., 2012.
2. Stephen D Senturia, 'Microsystem Design', Springer Publication, 2000.
3. Tai Ran Hsu, "MEMS & Micro systems Design and Manufacture" Tata McGraw Hill, New Delhi, 2002

REFERENCES:

1. Nadim Maluf," An Introduction to Micro Electro Mechanical System Design", Artech House, 2000
2. Mohamed Gad-el-Hak, editor, " The MEMS Handbook", CRC press Baco Raton, 2001.
3. Julian w. Gardner, Vijay K. Varadan, Osama O.Awadelkarim, Micro Sensors MEMS and Smart Devices, John Wiley & Son LTD, 2002
4. James J.Allen, Micro Electro Mechanical System Design, CRC Press Publisher, 2005.
5. Thomas M.Adams and Richard A.Layton, "Introduction MEMS, Fabrication and Application," Springer, 2010.

WEB REFERENCES:

1. https://www.lboro.ac.uk/microsites/mechman/research/ipm
2. ktn/pdf/Technology_review/an-introduction-to-mems.pdf

ONLINE COURSES / RESOURCES:

1. https://nptel.ac.in/courses/117105082
2. https://www.digimat.in/nptel/courses/video/112108092/L01.html

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(Alumnus Representative)

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