PANIMALAR ENGINEERING COLLEGE

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

FACULTY OF COMPUTER SCIENCE & INFORMATION TECHNOLOGY

CURRICULUM AND SYLLABUS

REGULATION-2021

PROGRAMME EDUCATIONAL OBJECTIVES (PEO)

1. To provide Excellent Knowledge on Fundamental Computing Technology and Embedded System to inculcate interest and awareness in IT the stream.
2. To mould the student to synchronize the acquired theoretical knowledge with practical applications in real time situations.
3. To provide an insight for analyzing current trends, to explore the future issues in different perspectives of the computing environment.
4. To Stimulate the student to appear for the competitive examinations, to pursue higher studies and to continue the learning process with effective communication in technical aspects, to function efficiently as a team, individual and apply the acquired knowledge with in global, communal and to the stipulated environment.
5. To explore the acquired knowledge for developing innovative ideas, to become an Entrepreneur.

PROGRAM OUTCOMES (PO)

PO1 (Engineering knowledge): Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2 (Problem Analysis): Identify, formulate, research literature, and analyze complex engineering problem reaching substantiated conclusions using first principles of mathematics,natural sciences, and engineering sciences.

PO3(Design/development of solutions): Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4 (Conduct investigations of complex problems): Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5(Modern tool usage): Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO6(The engineer and society): Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the Professional engineering practice.

PO7 (Environment and sustainability): Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8 (Ethics): Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice

PO9 (Individual and team work): Function effectively as an individual, and as a memberor leader in diverse teams, and in multidisciplinary settings

PO10(Communication): Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11 (Project management and finance): Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO12 (Life-long learning): Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAMME SPECIFIC OUTCOMES (PSO)

- **PSO1**: System Formulation: Apply Computing techniques to resolve issues with reasonable investigation for advancement.

- **PSO2:** System Design: Analyze systems for modeling and to provide domain specific solutions.

- **PSO3:** System Exploration: Explore new and emerging technologies leading to innovations in the field of Information Technology.

OPEN ELECTIVE – I

21CE1010	AIR POLLUTION AND CONTROL ENGINEERING	L	T	P	C
		3	0	0	3

OBJECTIVES: To impart Knowledge on the following topics:

- To impart knowledge on the principle and design of control of Indoor/ particulate/ gaseous air pollutant and its emerging trends.

UNIT - I INTRODUCTION 9

Structure and composition of Atmosphere – Definition, Scope and Scales of Air Pollution – Sources and classification of air pollutants and their effect on human health, vegetation, animals, property, aesthetic value and visibility- Ambient Air Quality and Emission standards –Ambient and stack sampling and Analysis of Particulate and Gaseous Pollutants.

UNIT - II METEOROLOGY 9

Effects of meteorology on Air Pollution - Fundamentals, Atmospheric stability, Inversion, Wind profiles and stack plume patterns- Atmospheric Diffusion Theories – Dispersion models, Plume rise.

UNIT - III CONTROL OF PARTICULATE CONTAMINANTS 9

Factors affecting Selection of Control Equipment – Gas Particle Interaction – Working principle, Design and performance equations of Gravity Separators, Centrifugal separators Fabric filters, Particulate Scrubbers, Electrostatic Precipitators – Operational Considerations.

UNIT - IV CONTROL OF GASEOUS CONTAMINANTS 9

Factors affecting Selection of Control Equipment – Working principle, Design and performance equations of absorption, Adsorption, condensation, Incineration, Bio scrubbers, Bio filters – Process control and Monitoring - Operational Considerations.

UNIT - V INDOOR AIR QUALITY MANAGEMENT 9

Sources, types and control of indoor air pollutants, sick building syndrome and Building related illness- Sources and Effects of Noise Pollution – Measurement – Standards –Control and Preventive measures.

TOTAL: 45 PERIODS

OUTCOMES:

On successful completion of the course student will be able to:

1. An understanding of the nature and characteristics of air pollutants, noise pollution and basic concepts of air quality management
2. Ability to identify, formulate and solve air and noise pollution problems
3. Ability to design stacks and particulate air pollution control devices to meet applicable standards.

4. Ability to select control equipment's.

5. Ability to ensure quality, control and preventive measures.
6. An understanding of the nature and characteristics of air pollutants, noise pollution and basic concepts of air quality management

TEXT BOOKS:

1. Lawrence K. Wang, Norman C. Pareira, Yung Tse Hung, "Air Pollution Control Engineering", Tokyo, springer science + science media LLC,2004.
2. Noel de Nevers, "Air Pollution Control Engineering", Waveland press,Inc 2017.
3. Anjaneyulu. Y, "Air Pollution and Control Technologies", Allied Publishers (P) Ltd., India 2002.

REFERENCES:

1. David H.F. Liu, Bela G. Liptak, "Air Pollution", Lweis Publishers, 2000.
2. Arthur C. Stern, "Air Pollution (Vol.I – Vol.VIII)", Academic Press, 2006.
3. Wayne T.Davis, "Air Pollution Engineering Manual", John Wiley & Sons, Inc, 2000.
4. M.N Rao and HVN Rao, "Air Pollution", Tata Mcgraw Hill Publishing Company limited,2007.
5. C.S.Rao, "Environmental Pollution Control Engineering", New Age International(P) Limited Publishers,2006.

21CE1001	ENERGY CONSERVATION AND MANAGEMENT	L	T	P	C
		3	0	0	3

OBJECTIVES: To impart Knowledge on the following topics:

- To impart knowledge on the principle of Energy Conversion and Management
- To provide details of Energy Conservation, Energy Management &. Audit.
- To impart knowledge on the principle of Energy Conversion and Management

UNIT - I ENERGY SCENARIO AND ENERGY CONSERVATION ACT 2001 **9**

Classification of Energy, Indian energy scenario, Sectorial energy consumption (domestic, industrial and other sectors), energy needs of growing economy, energyintensity, long term energy scenario, energy pricing, energy security, energy conservation and its importance, energy strategy for the future.

Energy conservation Act 2001 and its features, notifications under the Act, Schemes of Bureau of Energy Efficiency (BEE) including Designated consumers, State Designated Agencies, Electricity Act 2003, Integrated energy policy, National action plan on climate change, ECBC code for Building Construction.

UNIT - II FINANCIAL MANAGEMENT, ENERGY MONITORING AND TARGETING **9**

Investment-need, financial analysis techniques simple payback period, return on investment, net present value, internal rate of return, cash flows, risk and sensitivity analysis; financing options, energy performance contracts and role of Energy Service Companies (ESCOs).Defining monitoring & targeting, elements of monitoring & targeting, data and information-analysis, techniques – energy consumption, production, cumulative sum of differences (CUSUM). Energy Management Information Systems (EMIS)

UNIT - III ENERGY MANAGEMENT & AUDIT **9**

Definition, energy audit, need, types of energy audit. Energy management (audit) approach-understanding energy costs, Bench marking, energy performance, matching energy use to requirement, maximizing system efficiencies, optimizing the input energy requirements, fuel and energy substitution, energy audit instruments and metering.

UNIT - IV ENERGY EFFICIENCY IN THERMAL UTILITIES AND SYSTEMS **9**

Boilers: Types, combustion in boilers, performances evaluation, analysis of losses, feed water treatment, blow down, energy conservation opportunities. Boiler efficiency calculation, evaporation ratio and efficiency for coal, oil and gas. Soot blowing and soot deposit reduction, reasons for boiler tube failures, start up, shut down and preservation.

Steam System: Properties of steam, assessment of steam distribution losses,

steamleakages, steam trapping, condensate and flash steam recovery system, identifying opportunities for energy savings. Steam utilization, Performance assessment of steam system, thermo- compressor, steam pipe insulation, condensate pumping, steam dryers.
Waste Heat Recovery: Classification, advantages and applications, commercially viable waste heat recovery devices, saving potential.

UNIT - V ENERGY AND ENVIRONMENT, AIR POLLUTION, CLIMATE CHANGE **9**

United Nations Framework Convention on Climate Change (UNFCC), sustainable development, Kyoto Protocol, Conference of Parties (COP), Clean Development Mechanism (CDM), CDM Procedures case of CDM – Bachat Lamp Yojna and industry; Prototype Carbon Fund (PCF).

TOTAL: 45 PERIODS

OUTCOMES:

On successful completion of the course student will be able to:

1. To summarized the energy conservation scenario, energy and environment, air pollution, climate change, and various acts and policy for the energy conservation.
2. To infer the concept of financial management, energy monitoring and targeting.
3. To apply the knowledge of energy audit for the energy management and operation of energy audit instruments.
4. To analyze the energy saving area and improvement in efficiency of various thermal utilities and systems.
5. To evaluate the net present worth in financial management and performance
6. assessment of various thermal utilities and systems.

TEXT BOOKS:

1. Energy Management Handbook, W.C. Turner, John Wiley and Sons, A Wiley Inter science publication.
2. Energy Conservation Guidebook, Dale R Patrick, Stephen W Fardo, 2nd Edition, CRC Press

REFERENCES:

1. Handbook of Energy Audits, Albert Thumann, 6th Edition, The Fairmont Press.
2. Bureau of Energy Efficiency Reference book: No.1, 2, 3, 4.
3. Carbon Capture and Sequestration: Integrating Technology, Monitoring, and Regulation edited by E J Wilson and D Gerard, Blackwell Publishing

21GE1004	HOSPITAL WASTE MANAGEMENT	L	T	P	C
		3	0	0	3

OBJECTIVES: To impart Knowledge on the following topics:

- Understand the hazardous materials used in
- Understand various waste disposal procedures and management.
- Understand the various facility guidelines of administrative area safety and control of hazardous energy
- Understand the inputs of healthcare immunizations and medication safety.

UNIT - I HEALTHCARE HAZARD CONTROL AND UNDERSTANDING ACCIDENTS 9

Healthcare Hazard Control: Introduction, Hazard Control, Hazard Control Management and responsibilities, Hazard Analysis, Hazard Control and Correction, Personal Protective Equipment, Hazard Control Committees and System Safety. Understanding Accidents: Accident Causation Theories, Human Factors, Accident Deviation Models, Accident Reporting, Accident Investigations, Accident Analysis, Organizational Functions That Support Accident Prevention, Workers' Compensation.

UNIT - II BIOMEDICAL WASTE MANAGEMENT 9

Biomedical Waste Management : Types of wastes, major and minor sources of biomedical waste, Categories and Classification of biomedical waste, hazard of biomedical waste, need for disposal of biomedical waste, waste minimization, waste segregation and labelling, waste handling, collection, storage and transportation, treatment and disposal.

UNIT - III HAZARDOUS MATERIALS 9

Hazardous Materials : Hazardous Substance Safety, OSHA Hazard Communication Standard, DOT Hazardous Material Regulations, Healthcare Hazardous Materials, Medical Gas Systems, Hazardous Waste Operations and Emergency Response Standard, Respiratory Protection.

UNIT - IV FACILITY SAFETY 9

Facility Safety : Introduction, Facility Guidelines: Institute, Administrative Area Safety, Slip, Trip, and Fall Prevention, Safety Signs, Colours, and Marking Requirements, Tool Safety, Machine Guarding, Compressed Air Safety, Electrical Safety, Control of Hazardous Energy, Landscape and Grounds Maintenance, Fleet and Vehicle Safety.

UNIT - V INFECTION CONTROL, PREVENTION AND PATIENT SAFETY 9

Healthcare Immunizations, Centres for Disease Control and Prevention, Disinfectants , Antiseptics, OSHA Blood borne Pathogens Standard and Healthcare Opportunistic Infections. Patient Safety: An Organizational Function, Errors and Adverse Events, Safety Cultures, Patient-Centred Healthcare

TOTAL: 45 PERIODS

OUTCOMES:

On successful completion of the course student will be able to:

1. Analyse various hazards, accidents and its control.
2. Design waste disposal procedures for different biomedical wastes.
3. Categorize different biomedical wastes based on its properties.
4. Outline the Hazardous safety and its Healthcare hazardous Material regulations.
5. Design different safety facility in hospitals.
6. Propose various regulations and safety norms.

TEXT BOOKS:

1. Tweedy, James T., Healthcare
2. Anantpreet Singh, SukhjitKaur, Biomedical Waste Disposal, Jaypee Brothers Medical Publishers (P) Ltd (2012).
3. Solid and Hazardous Waste Management, Second Edition by M.N. Rao (Author), Razia Sultana (Author)-BS Publications.
4. Infectious and Medical Waste Management By Peter A. Reinhardt –CRC Press

REFERENCES:

1. R.C.Goyal, “Hospital Administration and Human Resource Management”, PHI – Fourth Edition,2006
2. J. Landrum, “Medical Waste Management and disposal”, Elsevier, 1991

21CY1001	INDUSTRIAL NANOTECHNOLOGY	L	T	P	C
		3	0	0	3

OBJECTIVES: To impart Knowledge on the following topics:

- To learn about basis of nanomaterial science.
- To learn about preparation of nanomaterials.
- To learn about characterizations of nanomaterials.
- To learn about applications of nanomaterials in medicine and engineering

UNIT - I INTRODUCTION OF NANOTECHNOLOGY 9

Origin of nanoscale Science and Technology - Implications for Physics, Chemistry, Biology and Engineering - Classifications of nanostructured materials- nanoparticles- quantum dots, nanowires- ultra-thinfilms - multilayered materials. Effects of nanoscale materials on physicochemical, mechanical, electronic and optical properties.

UNIT - II PREPARATION METHODS 9

Bottom-up synthesis and top-down approach - co-precipitation, sol-gel method, electro deposition, self-assembly, sputtering, mechanical ball milling and vapour phase deposition.

UNIT - III CHARACTERIZATION TECHNIQUES 9

X-ray diffraction technique (XRD), Scanning Electron Microscope (SEM) - environmental techniques - Transmission Electron Microscopy including high-resolution imaging (HRTEM), Surface Analysis techniques - Atomic Force Microscope (AFM), Scanning Probe Microscope (SPM), Scanning Tunneling microscope (STM) and Nano indentation

UNIT - IV NANOTECHNOLOGY IN MEDICINE 9

Nano biotechnology: Nano-probes in medical diagnostics and biotechnology, Nano medicines, Targeted drug delivery, Bio-imaging, Quantum dots for cancer treatment nanorobotics for surgery - Micro Electro Mechanical Systems (MEMS), Nano Electro Mechanical Systems (NEMS) for healthcare - nano-crystalline silver for bacterial inhibition.

UNIT - V NANOTECHNOLOGY IN ENGINEERING 9

NanoInfoTech: Information storage- nanocomputer, molecular switch, super chip. Nanoparticles for sunbarrier products - In Photostat, printing, solar cell, battery. Sensors – Classification, Types of sensors, properties, biosensors, nanosensors, nanobiosensors. Nanotoxicity.

TOTAL: 45 PERIODS

OUTCOMES:

On successful completion of the course student will be able to:

1. Familiarize about the science of nanomaterial's.
2. Demonstrate the preparation of nanomaterial's
3. Develop the knowledge in characteristic nanomaterial.
4. Understand about the role of nanotechnology in the field of medicine.
5. Understand applications of nanoscience in technology.
6. Understand applications of nanoscience in sensors.

TEXT BOOKS:

1. A.S. Edelstein and R.C. Cammearata, eds., "Nanomaterials: Synthesis, Properties and Applications", Institute of Physics Publishing, Bristol and Philadelphia, 1996.
2. N John Dinardo, "Nanoscale Charecterisation of surfaces & Interfaces", 2nd edition, Weinheim Cambridge, Wiley-VCH, 2000.
3. Christof M. Niemeyer, Chad A. Mirkin, Nanobiotechnology, Concepts, Applications

REFERENCES:

1. G Timp, "Nanotechnology", AIP press/Springer, 1999.
2. Malsch, Neelina H, (et), Biomedical Nanotechnology, Washington, DC; CRC Press, 2005
3. AkhleshLakhtakia,"The Hand Book of Nano Technology, Nanometer Structure, Theory, Modeling and Simulations". Prentice-Hall of India (P) Ltd, New Delhi, 2007.
4. Hocine Yahia Shape Memory Implants, Springer Verlag, 2000.

21EE1003	LOGIC AND DISTRIBUTED CONTROL SYSTEM	L	T	P	C
		3	0	0	3

OBJECTIVES: To impart Knowledge on the following topics:

- To give an introductory knowledge about PLC and the programming languages.
- To give basic knowledge in the architecture and local control unit of distributed control system.
- To give basic knowledge about Computer Controlled Systems
- To give adequate information in the interfaces used in DCS.

UNIT-I PLC & SCADA 9

PLC: Evolutions of PLCs – Programmable Controllers – Architecture, I/O modules – Comparative study of Industrial PLCs. SCADA: Remote terminal units- Master station - Communication architectures

UNIT-II BASICS OF PLC PROGRAMMING(LADDER) 9

Basics of PLC programming – Ladder Logic – Relay type instructions – Timer/Counter instructions – Program control instructions – Data manipulation and math instructions – Programming Examples .

UNIT-III PLC PROGRAMMING (OTHER LANGUAGES) 9

Functional block programming - Sequential function chart – Instruction list – Structured text programming – PLC controlled sequential Process Examples.

UNIT-IV DISTRIBUTED CONTROL SYSTEM 9

DCS: Evolution & types – Hardware architecture – Field control station – Interfacing of conventional and smart field devices (HART and FF enabled) with DCS Controller – Communication modules – Operator and Engineering Human interface stations – Study of any one DCS available in market.

UNIT-V ADVANCED TOPICS IN AUTOMATION 9

Introduction to Networked Control systems – Plant wide control – Internet of things – Cloud based Automation – OLE for Process Control – Safety PLC – Case studies: PLC - SCADA – DCS

TOTAL:45PERIODS

OUTCOMES:

On successful completion of the course student will be able to:

1. Understand components such as PLC, SCADA, DCS,I/O modules and field devices of an industrial automation system.
2. Develop the program using PLC for industrial applications.
3. Program a PLC using ladder logic .
4. Describe the functionality of SCADA.

5. Understand the systems used in distributed control systems.

TEXTBOOKS:

1. F.D. Petruzella, Programmable Logic Controllers, Tata Mc-Graw Hill, Third edition, 2010.
2. Michael P. Lukas, Distributed Control Systems: Their Evaluation and Design, Van Nostrand Reinhold Co., 1986.
3. D. Popovic and V.P.Bhatkar,' Distributed computer control for industrial Automation' Marcel Dekker, Inc., Newyork ,1990.

REFERENCES:

1. Clarke, G., Reynders, D. and Wright, E., "Practical Modern SCADA Protocols: DNP3,4. 60870.5 and Related Systems", Newnes, 1st Edition, 2004.
2. Hughes, T.A., "Programmable Logic Controllers: Resources for Measurements and Control Series", 3rd Edition, ISA Press, 2004.
3. McMillan, G.K., "Process/Industrial Instrument and Controls Handbook", 5thEdition, McGraw- Hill handbook, New York, 1999.

21EC1011	TELE HEALTH TECHNOLOGY	L	T	P	C
		3	0	0	3

OBJECTIVES: To impart Knowledge on the following topics:

- To know telecommunication basics and practices
- Learn the key principles for telemedicine and health.
- Understand telemedical technology.
- Know telemedical standards, mobile telemedicine and it applications.

UNIT-I TELEMEDICINE AND HEALTH 9

History and Evolution of telemedicine, Organs of telemedicine, Global and Indian scenario, Ethical and legal aspects of Telemedicine - Confidentiality, Social and legal issues, Safety and regulatory issues, Advances in Telemedicine

UNIT-II TELEMEDICAL TECHNOLOGY 9

Principles of Multimedia - Text, Audio, Video, data, Data communications and networks, PSTN, POTS, ANT, ISDN, Internet, Air/ wireless communications Communication infrastructure for telemedicine – LAN and WAN technology. Satellite communication, Mobile communication.

UNIT-III TELEMEDICAL STANDARDS 9

Data Security and Standards: Encryption, Cryptography, Mechanisms of encryption, phases of Encryption. Protocols: TCP/IP, ISO-OSI, Standards to followed DICOM, HL7, H. 320 series Video Conferencing, Security and confidentiality of medical records, Cyber laws related to telemedicine.

UNIT-IV MOBILE TELEMEDICINE 9

Tele radiology: Image Acquisition system Display system, Tele pathology, Medical information storage and management for telemedicine- patient information, medical history, test reports, medical images, Hospital information system.

UNIT-V TELEMEDICAL APPLICATIONS 9

Telemedicine – health education and self-care. • Introduction to robotics surgery, Telesurgery. Telecardiology, Teleoncology, Telemedicine in neurosciences, Business aspects - Project planning and costing, Usage of telemedicine.

TOTAL:45PERIODS

OUTCOMES:

On successful completion of the course student will be able to:

1. Apply multimedia technologies in telemedicine
2. Explain protocols behind encryption techniques for secure transmission of data
3. Apply telehealth in healthcare

TEXTBOOKS:

1. Norris, A.C. Essentials of Telemedicine and Telecare, Wiley, 2002

2. Wootton, R., Craig, J., Patterson, V. (Eds.), Introduction to Telemedicine. Royal Society of Medicine Press Ltd, Taylor and Francis 2006 Wiley 1999 (unit-3,4&5)

REFERENCES:

1. OCarroll, P.W., Yasnoff, W.A., Ward, E., Ripp, L.H., Martin, E.L. (Eds), Public Health Informatics and Information Systems, Springer, 2003.
2. Ferrer-Roca, O., Sosa – Iudicissa, M. (Eds.), Handbook of Telemedicine. IOS Press (Studies in Health Technology and Informatics, Volume 54, 2002.
3. Simpson, W. Video over IP. A practical guide to technology and applications. Focal Press Elsevier, 2006.
4. Bemmel, J.H. van, Musen, M.A. (Eds.) Handbook of Medical Informatics. Heidelberg, Germany: Springer, 1997
5. Mohan Bansal " Medical Informatics", Tata McGraw-Hill, 2004.

OPEN ELECTIVE – II

21EE1001	BASIC CIRCUIT THEORY	L	T	P	C
		3	0	0	3

OBJECTIVES: To impart Knowledge on the following topics:

1. To introduce electric circuits and its analysis
2. To impart knowledge on solving circuit equations using network theorems
3. To introduce the phenomenon of resonance in coupled circuit
4. To educate on obtaining the transient response of circuits.
5. To introduce Phasor diagrams and analysis of three phase circuits
6. To introduce electric circuits and its analysis

UNIT - I BASIC CIRCUITS ANALYSIS CABLES 9

Resistive elements – Ohm's Law Resistors in series and parallel circuits – Kirchhoff's laws – Mesh current and node voltage - methods of analysis.

UNIT - II NETWORK REDUCTION AND THEOREMS FOR DC AND AC CIRCUITS 9

Network reduction: voltage and current division, source transformation – star delta conversion. Thevenins and Norton Theorems – Superposition Theorem – Maximum power transfer theorem – Reciprocity Theorem – Millman's theorem.

UNIT - III TRANSIENT RESPONSE ANALYSIS 9

L and C elements -Transient response of RL, RC and RLC Circuits using Laplace transform for DC input and A.C. sinusoidal input.

UNIT - IV THREE PHASE CIRCUITS 9

A.C. circuits – Average and RMS value - Phasor Diagram – Power, Power Factor and Energy.Analysis of three phase 3-wire and 4-wire circuits with star and delta connected loads, balanced & un balanced – phasor diagram of voltages and currents – power measurement in three phase circuits..

UNIT - V RESONANCE AND COUPLED CIRCUITS 9

Series and parallel resonance – their frequency response – Quality factor and Bandwidth - Self and mutual inductance – Coefficient of coupling – Tuned circuits – Single tuned circuits.

TOTAL: 45 PERIODS

OUTCOMES:

On successful completion of the course student will be able to:

1. Ability to comprehend the basics of circuit analysis.
2. Ability of solve electrical circuits using theorems
3. Ability to analyze the transient response
4. Able to comprehend the three phase circuits
5. Able to understand coupled circuits

TEXT BOOKS:

4. William H. HaytJr, Jack E. Kemmerly and Steven M. Durbin, “Engineering Circuits Analysis”, McGraw Hill publishers, edition, New Delhi, 2013.
5. Charles K. Alexander, Mathew N.O. Sadiku, “Fundamentals of Electric Circuits”, Second Edition, McGraw Hill, 2013.
6. Allan H. Robbins, Wilhelm C. Miller, “Circuit Analysis Theory and Practice”, Cengage Learning India, 2013
7. Sudhakar A and Shyam Mohan SP, “Circuits and Network Analysis and Synthesis”, McGraw Hill, 2015.

REFERENCES:

5. Chakrabarti A, “Circuits Theory (Analysis and synthesis), DhanpathRai& Sons, New Delhi, 1999.
6. Jegatheesan, R., “Analysis of Electric Circuits,” McGraw Hill, 2015.
7. Joseph A. Edminister, MahmoodNahri, “Electric circuits”, Schaum‟s series, McGrawHill, New Delhi, 2010.
8. M E Van Valkenburg, “Network Analysis”,Prentice-Hall of India Pvt Ltd, New Delhi, 2015
9. Mahadevan, K., Chitra, C., “Electric Circuits Analysis,” Prentice-Hall of India Pvt Ltd., New Delhi, 2015.

21CY1002	ENERGY TECHNOLOGY	L	T	P	C
		3	0	0	3

OBJECTIVES: To impart Knowledge on the following topics:

1. To gain knowledge about different energy sources
2. To attain knowledge in energy conservation

UNIT - I ENERGY 9

Introduction to energy – Global energy scene – Indian energy scene - Units of energy, conversion factors, general classification of energy, energy crisis, environmental aspects of energy utilisation, energy alternatives.

UNIT - II CONVENTIONAL ENERGY 9

Conventional energy resources, Thermal, hydel and nuclear reactors, thermal, hydel and nuclear power plants, efficiency, merits and demerits of the above power plants, combustion processes, fluidized bed combustion.

UNIT - III NON-CONVENTIONAL ENERGY 9

Solar energy, solar thermal systems, flat plate collectors, focusing collectors, solar water heating, solar cooling, solar distillation, solar refrigeration, solar dryers, solar pond, solar thermal power generation, solar energy application in India, application of nano technology in solar energy conversion, energy plantations. Wind energy, types of windmills, wind electric power generation, wind power in India, economics of wind farm, ocean wave energy conversion, ocean thermal energy conversion, tidal energy conversion, geothermal energy, hydrogen energy.

UNIT - IV BIOMASS ENERGY 9

Biomass origin - Resources – Biomass estimation. Thermochemical conversion – Biological conversion, Chemical conversion – Hydrolysis & hydrogenation, solvolysis, biocrude, biodiesel power generation gasifier, biogas, bioCNG, integrated gasification.

UNIT - V ENERGY CONSERVATION 9

Energy conservation - Act; Energy management definition, importance, duties and responsibilities; Energy audit – need, Types methodology, reports, instruments. Benchmalcing and energy performance, material and energy balance, thermal energy management – waste to energy conservation technologies (plastic to petrol).

TOTAL: 45 PERIODS

OUTCOMES:

On successful completion of the course student will be able to:

1. Become intellectual in energy studies
2. Understand conventional Energy sources.
3. Understand the concept of various non-conventional energy resources

4. Attain knowledge in biomass sources and develop design parameters for equipments to be used in chemical process industries
5. Understand energy conservation in process industries

TEXT BOOKS:

1. Rao, S. and Parulekar, B.B., Energy Technology, Khanna Publishers, 2005.
2. Rai, G.D., Non-conventional Energy Sources, Khanna Publishers, New Delhi, 1984.
3. Nagpal, G.R., Power Plant Engineering, Khanna Publishers, 2008.
4. Energy Management, Paul W.O"Callaghan McGraw – Hill, 1993
5. Khan B.H. Non-Conventional Energy Resources, The McGraw Hills, 2nd Edition 2016.

REFERENCES:

1. NejatVezirog, Alternate Energy Sources, IT, McGraw Hill, New York.
2. El. Wakil, Power Plant Technology, Tata McGraw Hill, New York, 2002.
3. Sukhatme. S.P., Solar Enery - Thermal Collection and Storage, Tata McGraw hill, New Delhi, 1981
4. . Handbook of Energy Audit by 7th edition Albert Thumann, P.E., C.E.M & William J Younger C.E.M, Faiment Press 2008
5. John W Twidell and Tony D Weir Renewable Energy Resources, Taylor and Francis, 2nd Edition 2006.

21EC1004	ELECTRONIC DEVICES	L	T	P	C
		3	0	0	3

OBJECTIVES: To impart Knowledge on the following topics:

- To acquaint the students with the construction, theory and operation of the basic electronic devices such as PN junction diode, Bipolar and Field effect Transistors, Power control devices, LCD and other Opto-electronic devices

UNIT-I **9**

SEMICONDUCTOR DIODE

PN junction diode, Current equations, Energy Band diagram, Diffusion and drift current densities, forward and reverse bias characteristics, Transition and Diffusion Capacitances, Switching Characteristics, Breakdown in PN Junction Diodes.

UNIT-II **9**

BIPOLAR JUNCTION TRANSISTORS

N PN -PNP - Operations-Early effect-Current equations – Input and Output characteristics of CE, CB, CC - h-parameter model, Ebers Moll Model, Multi Emitter Transistor.

UNIT-III **9**

FIELD EFFECT TRANSISTORS

JFETs – Drain and Transfer characteristics,-Current equations-Pinch off voltage and its significance- MOSFET- Characteristics- Threshold voltage -Channel length modulation, D- MOSFET, E-MOSFET- Characteristics – Comparison of MOSFET with JFET.

UNIT-IV **9**

SPECIAL SEMICONDUCTOR DEVICES

M Metal-Semiconductor Junction- MESFET, FINFET, PINFET, CNTFET, DUAL GATE MOSFET, Zener diode-Varactor diode - Gallium Arsenide device, LDR.

UNIT-V **9**

POWER DEVICES AND DISPLAY DEVICES

UJT, SCR, Diac, Triac, Power BJT- Power MOSFET- DMOS-VMOS, LCD, Photo transistor, Opto Coupler, CCD.

TOTAL:45PERIODS

OUTCOMES:

On successful completion of the course student will be able to:

1. Explain the V-I characteristics of semiconductor diode.
2. Classify the configurations of BJT and understand its equivalence circuits.
3. Understand the drain – transfer characteristics of FET.
4. Illustrate the characteristics of special semiconductor devices.
5. Outline the concepts of power devices.
6. Outline the concepts of display devices.

TEXTBOOKS:

1. Donald A Neaman, —Semiconductor Physics and Devicesǁ, Fourth Edition, Tata McGrawHill Inc. 2012.
2. Salivahanan. S, Suresh Kumar. N, Vallavaraj.A, —Electronic Devices and circuitsǁ, Third Edition, Tata McGraw- Hill, 2008.

REFERENCES:

1. Robert Boylestad and Louis Nashelsky, —Electron Devices and Circuit Theory Pearson Prentice Hall, 10th edition, July 2008.
2. R.S.Sedha, — A Text Book of Applied Electronics S.Chand Publications, 2006.
3. Yang, —Fundamentals of Semiconductor devices, McGraw Hill International Edition,1978.

21CE1009	ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT	L	T	P	C
		3	0	0	3

OBJECTIVES: To impart Knowledge on the following topics:

- To impart the knowledge and skills to identify, assess and mitigate the environmental and social impacts of developmental projects

UNIT-I INTRODUCTION 9

Impacts of Development on Environment – Rio Principles of Sustainable Development- Environmental Impact Assessment (EIA) – Objectives – Historical development – EIA Types – EIA in project cycle –EIA Notification and Legal Framework.

UNIT-II ENVIRONMENTAL ASSESSMENT 9

Screening and Scoping in EIA – Drafting of Terms of Reference, Baseline monitoring, Prediction and Assessment of Impact on land, water, air, noise, flora and fauna - Matrices – Networks – Checklist Methods - Mathematical models for Impact prediction.

UNIT-III ENVIRONMENTAL MANAGEMENT PLAN 9

Plan for mitigation of adverse impact on water, air and land, water, energy, flora and fauna – Environmental Monitoring Plan – EIA Report Preparation – Public Hearing- Environmental Clearance

UNIT-IV SOCIO ECONOMIC ASSESSMENT 9

Baseline monitoring of Socio economic environment – Identification of Project Affected Personal – Rehabilitation and Resettlement Plan- Economic valuation of Environmental impacts – Cost benefit Analysis-

UNIT-V CASE STUDIES 9

EIA case studies pertaining to Infrastructure Projects – Roads and Bridges – Mass Rapid Transport Systems - Airports - Dams and Irrigation projects - Power plants.

TOTAL:45PERIODS

OUTCOMES:

On successful completion of the course student will be able to:

1. Carry out scoping and screening of developmental projects for environmental and social assessments
2. Explain different methodologies for environmental impact prediction and assessment
3. Plan environmental impact assessments and environmental management plans
4. Evaluate environmental impact assessment reports

TEXTBOOKS:

1. Canter, R.L, “Environmental impact Assessment “, 2nd Edition, McGraw Hill Inc, New Delhi,1995.

2. Lohani, B., J.W. Evans, H. Ludwig, R.R. Everitt, Richard A. Carpenter, and S.L. Tu, “Environmental Impact Assessment for Developing Countries in Asia”, Volume 1 – Overview, Asian Development Bank,1997.

3. Peter Morris, RikiTherivel “Methods of Environmental Impact Assessment”, Routledge Publishers,2009.

REFERENCES:

1. Becker H. A., Frank Vanclay,“The International handbook of social impact assessment” conceptual and methodological advances, Edward Elgar Publishing,2003.
2. Barry Sadler and Mary McCabe, “Environmental Impact Assessment Training Resource Manual”, United Nations Environment Programme,2002.
3. Judith Petts, “Handbook of Environmental Impact Assessment Vol. I and II”, Blackwell Science New York, 1998.
4. Ministry of Environment and Forests EIA Notification and Sectoral Guides, Government of India, New Delhi, 2010.

21GE1003	HOSPITAL MANAGEMENT	L	T	P	C
		3	0	0	3

OBJECTIVES: To impart Knowledge on the following topics:

- 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 **9**

OVERVIEW OF HOSPITAL ADMINISTRATION

Distinction between Hospital and Industry, Challenges in Hospital Administration – Hospital Planning- Equipment Planning – Functional Planning - Role of hospital administration – Hospital system – Need for scientific planning and design of hospitals

UNIT-II **9**

HUMAN RESOURCE MANAGEMENT IN HOSPITAL

Principles of HRM – Functions of HRM – Profile of HRD Manager – Human Resource Inventory – Manpower Planning – Significance – Importance of HR Planning – Factors influencing HR Planning Process – Job Analysis

UNIT-III **9**

RECRUITMENT AND TRAINING

Different Departments of Hospital, Recruitment, Selection, Training Guidelines – Methods of Training – Evaluation of Training – Leadership grooming and Training, Promotion – Transfer Performance Appraisals: Techniques & Practices

UNIT-IV **9**

SUPPORTIVE SERVICES

Medical Records Department – Central Sterilization and Supply Department – Pharmacy – Food Services - Laundry Services –Transportation services – Mortuary services – Hospital security services

UNIT-V **9**

COMMUNICATION AND SAFETY ASPECTS IN HOSPITAL

Purposes – Planning of Communication, Modes of Communication – Telephone, ISDN, Public Address and Piped Music – CCTV. Security – Loss Prevention – Fire Safety – Alarm System – Safety Rules – Challenges of e-health – electronic medical records

TOTAL:45PERIODS

OUTCOMES:

On successful completion of the course student will be able to:

1. Explain the principles of Hospital administration
2. Identify the importance of Human resource management
3. List various marketing research techniques
4. Identify Information management systems and its uses
5. Explain the principles of Hospital administration

TEXTBOOKS:

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
3. Stephen P. Robbins and Mary Coulter, Management (Prentice Hall of India Pvt. Ltd., New Delhi)
4. J.E. Park and K. Park, Textbook of Preventive and Social Medicine (M/S BanarsidasBhanot Publishers, Jabalpur)
5. Elaine La Monica, Management in Health Care (Macmillan Press Ltd, London) References
6. B.M. Sakharkar, Principles of Hospital Administration and Planning (Jaypee Brothers Medical Publishers Pvt. Ltd., New Delhi)

REFERENCES:

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.

21EC1002	MEDICAL ELECTRONICS	L	T	P	C
		3	0	0	3

OBJECTIVES: To impart Knowledge on the following topics:

- To gain knowledge about the various physiological parameters both electrical and non electrical and the methods of recording and also the method of transmitting these parameters
- To study about the various assist devices used in the hospitals
- To gain knowledge about equipment used for physical medicine and the various recently developed diagnostic and therapeutic techniques.

UNIT-I ELECTRO-PHYSIOLOGY AND BIO-POTENTIAL RECORDING 9

Sources of bio medical signals, Bio-potentials, Biopotential electrodes, biological amplifiers, ECG, EEG, EMG, PCG, typical waveforms and signal characteristics

UNIT-II BIO-CHEMICAL AND NON ELECTRICAL PARAMETER MEASUREMENT 9

pH, PO2, PCO2, Colorimeter, Blood flow meter, Cardiac output, respiratory, blood pressure, temperature and pulse measurement, Blood Cell Counters.

UNIT-III ASSIST DEVICES 9

Cardiac pacemakers, DC Defibrillator, Dialyser, Ventilators, Magnetic Resonance Imaging Systems, Ultrasonic Imaging Systems.

UNIT-IV PHYSICAL MEDICINE AND BIOTELEMETRY 9

Diathermies- Shortwave, ultrasonic and microwave type and their applications, Surgical Diathermy, Biotelemetry.

UNIT-V RECENT TRENDS IN MEDICAL INSTRUMENTATION 9

Telemedicine, Insulin Pumps, Radio pill, Endomicroscopy, Brain machine interface, Lab on a chip.

TOTAL:45PERIODS

OUTCOMES:

On successful completion of the course student will be able to:

1. Know the human body electro- physiological parameters and recording of bio-potentials
2. Comprehend the non-electrical physiological parameters and their measurement – body temperature, blood pressure, pulse, blood cell count, blood flow meter etc.
3. Interpret the various assist devices used in the hospitals viz. pacemakers, defibrillators, dialyzers and ventilators

4. Comprehend physical medicine methods eg. ultrasonic, shortwave, microwave surgical diathermies, and bio-telemetry principles and methods
5. Know about recent trends in medical instrumentation

TEXTBOOKS:

1. Khandpur, R.S., “Handbook of Biomedical Instrumentation”, TATA McGraw-Hill, New Delhi, 2003.

REFERENCES:

1. Leslie Cromwell, “Biomedical Instrumentation and Measurement”, Prentice Hall of India, New Delhi, 2007.
2. John G.Webster, “Medical Instrumentation Application and Design”, 3rd Edition, Wiley India Edition, 2007
3. Joseph J.Carr and John M.Brown, “Introduction to Biomedical Equipment Technology”, John Wiley and Sons, New York, 2004

21EC1006	SIGNALS AND SYSTEMS	L	T	P	C
		3	0	0	3

OBJECTIVES: To impart Knowledge on the following topics:

- To understand the basic properties of signals.
- To analyze the basic systems using properties.
- To analyze the characteristics of continuous time signals in the Fourier and Laplace domain
- To analyze LTI – Continuous time systems in Time domain and Frequency domain
- To analyze the characteristics of Discrete time signals in the Fourier and Z transform domain
- To analyze LTI - Discrete time systems in Time domain and Frequency domain

UNIT- I CLASSIFICATION OF SIGNALS AND SYSTEMS 9

Standard signals- Step, Ramp, Pulse, Impulse, Real and complex exponentials and Sinusoids_Classificationofsignals – Continuous time (CT) and Discrete Time (DT) signals, Periodic &Aperiodic signals, Deterministic & Random signals, Energy & Power signals - Classification of systems- CT systems and DT systems- – Linear & Nonlinear, Time-variant & Time-invariant, Causal & Non-causal, Stable & Unstable.

UNIT- II ANALYSIS OF CONTINUOUS TIME SIGNALS 9

Fourier Series for periodic signals -Analysis of Continuous Time Signals using Fourier Transform – Inverse FT -Properties of FT, CT analysis using Laplace Transform- Unilateral LT and Bilateral LT- Inverse LT- Properties of Unilateral LT.

UNIT- III LINEAR TIME INVARIANT CONTINUOUS TIME SYSTEMS 9

Impulse response - convolution integrals – Graphical method - Properties of convolution integral- Overall impulse response for interconnected systems - Fourier and Laplace transforms in Analysis of CT systems - Solving of Differential Equation.

UNIT- IV ANALYSIS OF DISCRETE TIME SIGNALS 9

Baseband signal sampling -Analysis of Discrete Time Signals using Discrete Time Fourier Transform (DTFT)- Inverse DTFT–Properties of DTFT- Analysis of Discrete Time Signals using Z-Transform – Inverse Z-Transform - Properties of Z-Transform.

UNIT- V LINEAR TIME INVARIANT-DISCRETE TIME SYSTEMS 9

Impulse response – Convolution sum –Graphical method - Properties of Discrete Convolution- Overall iimpulse response for interconnected systems -Solving of Difference equations- Solution of Difference equation using DTFT- solution of difference equation using Z-transform.

TOTAL:45PERIODS

OUTCOMES:

On successful completion of the course student will be able to:

1. Understand the basics of signals and its classifications
2. Analyze the basic systems and its classifications
3. Determine the frequency Response for Deterministic signal and also analyze in S-domain
4. Apply the Fourier and Laplace Transform for the analysis of LTI -Continuous Time systems
5. Analyze the Characteristics of DT signals by using DTFT and Z-transform
6. Apply the Fourier and Z- Transform for the analysis of LTI –Discrete Time systems

TEXTBOOKS:

1. Allan V.Oppenheim, S.Wilsky and S.H.Nawab, “Signals and Systems”,Pearson,2015.
2. S. Haykin and B. Van Veen, "Signals and Systems", 2nd Edition, Wiley, 2007.

REFERENCES:

1. B.P.Lathi,“Principles of Linear Systems and Signals”,Second Edition,Oxford,2009.
2. R.E.Zeimer,W.H.Tranter and R.D.Fannin,“Signals &Systems-Continuous and Discrete”,Pearson,2007.
3. John Alan Stuller,“An Introduction to SignalsandSystems”,Thomson,2007.

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

OBJECTIVES: To impart Knowledge on the following topics:

- Illustrate the life cycle phases and framework for systems engineering.
- Describe about systems engineering process.
- Apply ergonomic and system dynamic models for evaluation of alternatives.
- Create knowledge on Reliability, Markov and Time series models for analysis f alternatives.
- 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:45PERIODS

OUTCOMES:

On successful completion of the course student will be able to:

1. Be able to recognize life cycle phases in systems engineering.
2. Apply steps in systems engineering process for large scale problems.
3. Able to develop system dynamic models for analyzing alternatives.
4. Gain ability to evaluate alternatives in large scale problems.
5. Be able Attain confidence in assessment and arrive decisions for complex problems.

TEXTBOOKS:

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

REFERENCES:

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.

21ME1008	SUPPLY CHAIN MANAGEMENT	L	T	P	C
		3	0	0	3

OBJECTIVES: To impart Knowledge on the following topics:

- Describe the role and drivers of and supply chain management in achieving competitiveness.
- Explain about Supply Chain Network Design.
- Illustrate about the issues related to Logistics in Supply Chain
- Appraise about Sourcing and Coordination in Supply Chain.
- Application of Information Technology and Emerging Concepts in Supply Chain.

UNIT-I INTRODUCTION 9

Role of Logistics and Supply chain Management: Scope and Importance - Evolution of Supply Chain – Examples of supply Chains - Decision Phases in Supply Chain - Competitive and Supply chain Strategies – Drivers of Supply Chain Performance and Obstacles.

UNIT-II SUPPLY CHAIN NETWORK DESIGN 9

Role of Distribution in Supply Chain – Factors influencing Distribution network design – Design options for Distribution Network- Distribution Network in Practice - Role of network Design in Supply Chain – Framework for network Decisions.

UNIT-III LOGISTICS IN SUPPLY CHAIN 9

Role of transportation in supply chain – Factors affecting transportations decision – Design option for transportation network – Tailored transportation – Routing and scheduling in transportation - 3PL- 4PL- Global Logistics - Reverse Logistics; Reasons, Activities and issues.

UNIT-IV SOURCING AND COORDINATION IN SUPPLY CHAIN 9

Role of Sourcing in supply chain - Supplier selection - Contracts - Design Collaboration - Sourcing planning and analysis - Supply chain co-ordination - Bull whip effect – Effect of lack of co-ordination in supply chain and obstacles – Building strategic partnerships and trust within a supply chain.

UNIT-V IT AND EMERGING CONCEPTS IN SUPPLY CHAIN 9

The role IT in supply chain-The supply chain IT framework - Customer Relationship Management – Internal supply chain management – supplier relationship management – future of IT in supply chain – E-Business in supply chain- Introduction to Warehouse Management, Risks in Supply Chain, Lean supply Chains, Sustainable supply Chains.

TOTAL:45 PERIODS

OUTCOMES:

On successful completion of the course student will be able to:

1. Ability to understand the scope of Supply Chain Management and the Drivers of SC performance
2. Ability to design suitable SC network for a given situation

3. Ability to solve the issues related to Logistics in SCM
4. Ability to understand Sourcing, Coordination and current issues in SCM
5. Ability to appraise about the applications of IT in SCM and apply SCM concepts in selected enterprise

TEXTBOOKS:

1. Sunil Chopra, Peter Meindl and D.V. Kalra, “Supply Chain Management: Strategy, Planning, and Operation", Pearson Education, 2016.

REFERENCES:

1. Ravi Ravindran A, Donald P. Warsing, Jr, “Supply Chain Engineering: Models and Applications”, “CRC Press, 2012.
2. Srinivasan G.S, “Quantitative models in Operations and Supply Chain Management”, PHI, 2010

21CY1003	WASTE WATER TREATMENT	L	T	P	C
		3	0	0	3

OBJECTIVES: To impart Knowledge on the following topics:

- To provide basic under standings about the requirements of water, its preliminary treatment
- To give the students a broad understanding of all issues related to the analysis and design of water supply and wastewater disposal systems.

UNIT-I WATER AS A RESOURCE, ITS QUALITY & PARAMETERS 9

Water sources- water quantity- maintenance of water cycle- impurities in water- effects of impurities in water- water quality parameters- physical, chemical & biological. Characteristics of potable water- wastewater effluent standards -water quality indices. Need for water and wastewater treatment - associated environmental laws- drinking water and wastewater discharge standards, water reuse and recycling concepts.

UNIT-II INDUSTRIAL WATER TREATMENT 9

Filtration – size and shape characteristics of filtering media – sand filters hydraulics of filtration – design considerations – radial, up flow, high rate and multimedia filters, pressure filter. Water softening – lime soda, zeolite and demineralization processes-industrial water treatment for boilers.

UNIT-III CONVENTIONAL TREATMENT METHODS 9

Taste and odour control – adsorption – activated carbon treatment – removal of color – iron and manganese removal – aeration, oxidation, ion exchange and other methods – effects of fluorides – fluoridation and de fluoridation –desalination - conventional activated sludge process and its modifications – trickling filter, bio-towers and rotating biological contactors-corrosion prevention and control – factors influencing corrosion – Lange Lier index – corrosion control measures.

UNIT-IV WASTE WATER TREATMENT 9

Description and design of wastewater collection system- Quantity and quality of wastewater- wastewater treatment plant layout and related issues- Sewage and waste water treatments systems: A. Primary treatment methods - B. Secondary treatment methods and - C. Tertiary treatment methods. Equalization neutralization – screening and grid removal – sedimentation – oil separation gas stripping of volatile organics – biological oxidation – lagoons and stabilization basins – aerated lagoons - Chemical oxidation - types of reactors and reactors analysis

UNIT-V DOMESTIC WASTE WATER TREATMENT METHODS & RECENT TRENDS 9

Water purification systems in natural systems - Rate of water supplies for urban and rural systems. Unit operations and processes, treatment flow-diagrams for different sources of water. Water supply norms -Advanced water treatment, Automation in Water Supply and Smart Water Supply Systems, Package treatment units, implications

of 24x7 supply, Water Economics & Pricing and application of nano materials package treatment units

TOTAL:45PERIODS

OUTCOMES:

On successful completion of the course student will be able to:

1. Understand water quality standards and parameters
2. Understand the principles and operation of water treatment systems
3. Attain knowledge about the conventional treatment methods used in water
4. Analyze the various planning & design of waste water collection & conveyance and treatment systems.
5. Understand the need for advanced water treatment with automation in treatment, water economics and patented material

TEXTBOOKS:

1. Metcalf and Eddy, “Wastewater Engineering”, 4th ed., McGraw Hill Higher Edu., 2002.
2. W. Wesley Eckenfelder, Jr., “Industrial Water Pollution Control”, 2nd Edn., McGraw Hill Inc., 1989.

REFERENCES:

1. S.P. Mahajan, “Pollution control in process industries”, 27th Ed. Tata McGraw Hill Publishing Company Ltd., 2012.
2. M. Lancaster, “Green Chemistry: An Introductory Text”, 2nd edition, RSC publishing, 2010.
3. C.S. Rao, “Environmental Pollution Control Engineering”, New Age International, 2007.
4. Water Supply and Pollution Control. Authors: Warren Viessman Jr. and Mark J. Hammer. 7th Edition 2005. Publisher: Pearson Education
5. Wastewater Microbiology, 2nd Edition. Wiley-Liss; 2nd edition (February 16, 1999)