DAYANANDA SAGAR COLLEGE OF ENGINEERING

(An Autonomous Institute Affiliated to VTU, Belagavi, Approved by AICTE & ISO 9001:2015 Certified)
Accredited by National Board of Accreditation (NBA) & National Assessment Accreditation Council (NAAC) with 'A' grade,
Shavige Malleshwara Hills, Kumaraswamy Layout, Bengaluru-560078

SCHEME AND SYLLABUS OF INSTITUTION ELECTIVES OFFERED

for 7th semester students during the academic year

2021-2022

for Bachelor of Engineering programme

VISION OF THE INSTITUTE

To impart quality technical education with a focus on Research and Innovation emphasizing on Development of Sustainable and Inclusive Technology for the benefit of society.

MISSION OF THE INSTITUTE

1) To provide an environment that enhances creativity and Innovation in pursuit of Excellence.
2) To nurture teamwork in order to transform individuals as responsible leaders and entrepreneurs.
3) To train the students to the changing technical scenario and make them to understand the importance of Sustainable and Inclusive technologies.

LIST OF INSTITUTION ELECTIVES (2018 BATCH)

Sl No.	NAME OF THE DEPARTMENT	COURSE CODE	COURSE TITLE	SHOULD NOT BE OFFERED TO	MAX. NO. OF STUDENTS TO BE ALLOTTED
1	Aeronautical Engg.	18AE7IEBAI	BASICS OF AIRCRAFTS AND INSTRUMENTATION	AE	60
2	Automobile Engg.	18AU7IEAEL	AUTOMOTIVE ELECTRONICS	AU	60
3	Biotechnology	18BT7IEGTL	GREEN TECHNOLOGY	BT	60
4	Chemical Engg.	18CH7IEWSM	WASTE MANAGEMENT	CH, CV, BT	60
5	Civil Engg.	18CV7IEUHD	URBAN WASTE HANDLING AND DISPOSAL	CH, CV, BT	180
6	Computer Science & Engg.	18CS7IEIML	INTRODUCTION TO MACHINE LEARNING	CS, IS, EIE, EEE	240
7	Construction Technology & Management	18CT7IEBIS	BUILDING SCIENCE	CTM	60
8	Electrical & Electronics Engg.	18EE7IEECM	ENERGY CONSERVATION AND MANAGEMENT	EEE	120
9	Electronics & Communication Engg.	18EC7IE2GA	GPS & ITS APPLCIATIONS	E&TE	240
10	Industrial Engg. & Management	18IM7IETQM	TOTAL QUALITY MANAGEMENT	IEM, ME, AU	60
11	Information Science & Engg.	18IS7IEDBS	DATA BASE MANAGEMENT SYSTEMS	ISE , CSE	120
12	Electronics & Instrumentation Engg.	18EI7IESAI	SAFETY INSTRUMENTATION	EIE	60
13	Mechanical Engg.	18ME7IEIDE	INDUSTRIAL DESIGN AND ERGONOMICS	ME, IEM	180
14	Medical Electronics Engg.	18ML7IEMIT	MEDICAL IMAGING TECHNIQUES	ML	60
15	Telecommunication Engg.	18TE7IEWFT	WIRELESS COMMUNICATION AND FUTURE TRENDS	E&TE , ECE	120
16	Physics	18PH7IENST	NANO SCIENCE AND TECHNOLOGY	-------	60
17	Chemistry	18CM7IECEM	CHEMISTRY OF ENGINEERING MATERIALS	-------	60
18	Mathematics	18MA7IEDTS	DATA SCIENCE	-------	60
19	Humanities	18HS7IEUHV	UNIVERSAL HUMAN VALUES	----------	60

TABLE OF CONTENTS

BASICS OF AIRCRAFTS AND INSTRUMENTATION

Sub Code: 18AE7IEBAI	**Credits: 03**
L: T: P: S: 3: 0: 0: 0	**CIE Marks: 50**
Exam Hours: 03	**SEE Marks: 50**
Total hours: 40	

OBJECTIVES:

1) Understand the basic types of aircraft.
2) Understand the basic aircraft structure and related materials.
3) Gain knowledge on different instruments used in aircraft.
4) Understand the display system grouping and different and air data system.
5) Gain knowledge flight instruments and instrumentation technique.
6) Comprehend various parameters measuring system.

COURSE OUTCOMES:

After completion of the course, the graduates will be able to:

CO1	Comprehend the basic components of aircrafts, history of aviation and international standard atmosphere.
CO2	Recognize the basics of aerodynamics, aircraft structure and materials required for aircraft construction.
CO3	Understand different instruments used in aircraft.
CO4	Examine different air-data measuring instruments, direction indicator, turn and bank indicator.
CO5	Examine different display and navigation instruments; engine RPM, temperature measuring instruments.
CO6	Outline the performance of aircraft sensors and actuators used in aircraft systems

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3											
CO2	3	3										
CO3	3	3	3									
CO4	3											
CO5	3											
CO6	3											

COURSE CONTENTS

UNIT	Course Content	Hrs	COs
1	**INTRODUCTION TO AIRCRAFTS** History of aviation, International Standard atmosphere, Atmosphere and its properties, Temperature, Pressure and Altitude relationships, Classification of aircrafts, Anatomy of aircraft and helicopters. Basic components and their functions, Introduction to Unconventional and Autonomous Air Vehicles.	8	CO1, CO2

2	**BASICS OF AERODYNAMICS** Bernoulli's principle, Aerodynamic forces and moments on an airfoil, Lift and drag, Aerodynamic centre and centre of pressure. Aerodynamic coefficients, Wing planform geometry, Types of NACA airfoils, Simple problem on lift and drag. **AIRCRAFT STRUCTURES AND MATERIALS:** Introduction; General types of construction, Metallic and non-metallic	8	CO2, CO3
3	**AIRCRAFT INSTRUMENTS** Instruments displays, panels & layouts. Instrumentation grouping. Navigation instruments, Radio instruments. **AIR DATA INSTRUMENTS** Basic air data system and probes. Mach meter, Air speed indicator, Vertical speed indicator. Barometric pressure sensing. Altimeter, altitude alerting system.	8	CO4
4	**GYROSCOPIC FLIGHT INSTRUMENTS** The gyroscope and its properties. Limitations of a free gyroscope. Drift. Gyroscopic flight. Instruments -Pneumatic, and Electric. Direction indicator, Turn and Bank Indicator.	8	CO5
5	**ENGINE INSTRUMENTS** Study of various types of engine instruments- RPM, Pressure, Temperature, Fuel flow, Fuel quantity, and vibrations.	8	CO6

SELF-STUDY COMPONENT:

UNIT 1: Landing gear system functioning
UNIT 2: Crew escape aids and pilot seat ejection system.
UNIT 3: Stall and Mach warning systems

NOTE:

1) Questions for CIE and SEE not to be set from self-study component.
2) Assignment Questions should be from self-study component only.

TEXT BOOKS:

1) Ian Moir and Allan Seabridge, 'Aircraft Systems: Mechanical, Electrical and Avionics-Subsystem Integration ', AIAA Educational Series, 2001.
2) Pallet, E.H.J., "Aircraft Instruments and Integrated Systems", Longman Scientific and Technical, Indian reprint 1996.
3) William A Neese, 'Aircraft Hydraulic Systems ', Himalayan Books; 2007.

REFERENCE BOOKS:

1) Lalit Gupta and O P Sharma, 'Aircraft Systems (Fundamentals of Flight Vol. IV)', Himalayan Books; 2006.
2) Treager, S., "Gas Turbine Technology", McGraw-Hill, 1997.
3) R. W. Sloley and W. H. Coulthard, 'The aircraft Engineers Handbook, No 4, Instruments', Sterling Book House, 6th Edition, 2005.
4) S R Majumdar, 'Pneumatic Systems', Tata McGraw Hill Publishing Co.; 1995.

AUTOMOTIVE ELECTRONICS

Sub Code: 18AU7IEAEL	**Credits: 03**
L: T: P: S: 3: 0: 0: 0	**CIE Marks: 50**

Exam Hours: 03	**SEE Marks: 50**
Total hours: 40	

COURSE OUTCOMES:

After completion of the course, the graduates will be able to:

CO1	Identify and locate the position of sensors in an engine and explain their functions
CO2	Analyse the fuel and ingnition challenges in petrol
CO3	Understand combustion characteristics in diesel engines and challenges in fuel injection
CO4	Analyze the systems and be confidently integrate electronics with automobile ignition and fuel systems.
CO5	Develop components/systems with more functionality and reduced cost.
CO6	Support and Lead a team to develop automotive systems

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	1	2								
CO2	2	3	3	3								
CO3	2	3	2	2								
CO4	2	3	3	3								
CO5	2	3	3	3								
CO6	2	3	2	2								

COURSE CONTENTS

UNIT	Course Content	Hrs	COs
1	**Automotive Sensors and Actuators:** Active and Passive sensors, Automotive Sensors for temperature, speed, position and acceleration, mass air flow, vibration, oxygen concentration. Solenoid actuators, Motorised actuators, Stepper Motors.	**08**	**CO1 CO6 CO4**
2	**Gasoline Engines**: Evolution of Ignition system and Fuel systems. Combined ignition and fuel management systems. Evolution of petrol engines. carburetor, single point injection, MPFI and GDI. **Diesel Engines:** Working principle. combustion and pressure rise. Fuel injection systems, Algorithm of ignition timing calculation and Injection duration calculation	**08**	**CO1 CO6 CO4**
3	**Chassis Electrical Systems:** Antilock brakes, ABS components and its control, Active suspension and its components, Traction control and its control functions, Cruise control, Adaptive cruise control, Total vehicle Dynamics Drive by wire, Air bags and seat belt tensioners, keyless entry.	**08**	**CO1 CO3**
4	**Electric Vehicles:** Electric and Hybrid drive-train topologies, Basics of vehicle performance - resistances against vehicle motion, acceleration, maximum speed, Gradient and range calculation. Types of motors used in EV and HEV and their control.	**08**	**CO5 CO6**
5	**Hyrbrid Electric vehicles:** Introduction to Hybrid Electric Vehicles: social and environmental importance of hybrid and electric vehicles. **Energy Storage:** Battery, Fuel cell and capacitor based energy storage.	**08**	**CO4 CO6**

SELF-STUDY COMPONENT:

UNIT- 1: sensor specifications
UNIT- 2: Basics of Engines

UNIT - 4: Power Electronics for Motor control.
UNIT - 5: Case studies of hybrid vehicles.

NOTE:

1) Questions for CIE and SEE not to be set from self-study component.
2) Assignment Questions should be from self-study component only.

TEXT BOOKS:

1) Tom Denton, "Automobile Electrical and Electronic systems" SAE publication, 2000.
2) David A Crolla, 'Automotive Engineering", BH publisher, free E Book also available.

REFERENCE BOOKS:

1) Heinz Heisler, Advanced Engine Technology. SAE Publications, 1995.
2) Ulrich Adler, "Automotive Electronic Systems", Robert Bosch, GMBH, 1995
3) Bosch Technical Instruction Booklets.
4) A.P. Young & Griffiths, "Automobile Electrical Equipment", ELBS & Newnes Butterworths, London.
5) W. Judge, "Modern Electrical Equipment "
6) Electrical Equipment for Automobiles by Parker and smith S.

GREEN TECHNOLOGY

Sub Code: 18BT7IEGTL	**Credits: 03**
L: T: P: S: 3: 0: 0: 0	**CIE Marks: 50**
Exam Hours: 03	**SEE Marks: 50**
Total hours: 40	

OBJECTIVES:

1. To understand cell the importance of green technology
2. To study the potential of waste as renewable energy source
3. To appreciate the importance of carbon sequestration
4. To study the importance of hydrogen energy and fuel cells
5. To understand the concepts environment management and biodiversity conservation.

COURSE OUTCOMES:

After completion of the course, the graduates will be able to:

CO1	Ascertain green technology as a viable alternative
CO2	Determine the various processes involved in waste to energy conversion
CO3	Appraise on the importance of carbon sequestration
CO4	Investigate on hydrogen and fuel cells as alternative energy sources
CO5	Assess the importance of environment management and bioconservation
CO6	Prioritize environment friendly opportunities and design devices that create a safe environment for all

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	-	-	-	1	-	-	-	-	-	-
CO2	3	3	3	1	1	2	3	-	-	-	-	2

CO3	3	3	3	1	1	3	3	-	-	-	-	2
CO4	3	3	3	1	1	3	3	-	-	-	-	2
CO5	3	3	-	-	-	3	3	1	-	-	-	2
CO6	3	3	3	1	3	3	3	-	2	-	-	3
	3	3	3	1	1	3	3			-	-	2

COURSE CONTENTS

UNIT	Course Content	Hrs	COs
1	**INTRODUCTION TO GREEN TECHNOLOGY** Goals of green technology, rethinking, recycling, renewing reducing, responsibility, Types of green technology, green energy, green building, green purchasing, green chemistry green nanotechnology, Green cities in China as example, integrated renewable energy systems, applications of green technology	08	CO1
2	**WASTE TO ENERGY** Waste as a Renewable Energy Source, Waste-to-Energy Conversion, Thermochemical Conversion, Biochemical Conversion. Physico-chemical Conversion, Factors affecting Energy Recovery from waste, Agricultural Residues, Animal Waste, Industrial Wastes, Forestry Residues, Converting Waste Heat to Electricity, Bio energy as by product of waste processing Environmental significance, Introduction to anaerobic digestion, Methane production	08	CO2
3	**CARBON SEQUESTRATION AND SUSTAINABLE DEVELOPMENT** Climate change Mitigation and adaptation strategy, Carbon accounting, Carbon Market, Carbon capture and storage (Algae as model Potential Carbon sequestration (forest sinks), Oceanic, Terrestrial, Biological, geological Clean Coal Technology, Coal blending and gasification. Energy efficiency opportunities, Kyoto Protocol and Clean development Mechanism (eg of an industry), Emission benchmarks; Governments policies for mitigation and adaptation, National Action Plan on Climate Change .Carbon credits. Case studies	08	CO3
4	**HYDROGEN ENERGY & FUEL CELL** Hydrogen Energy – introduction and application, General introduction to infrastructure requirement for hydrogen production, storage, dispensing & utilization. Electrochemical: Electrolysis, Photo electro chemical. Biological: Photo Biological, Anaerobic Digestion Fermentative Micro- organisms. Physics and chemical properties: General storage methods, compressed storage, Glass micro sphere storage, Zeolities, Metal hydride storage, chemical hydride storage and cryogenic storage. Overview of hydrogen utilization: I.C. Engines, gas turbines, hydrogen burners, power plant, Principles of fuel cells, types of fuel cells, fuels for fuel cells, low, medium and high temperature fuel cells, power generation by fuel cells, Applications of fuel cells.	08	CO4

5	**ENVIRONMENT MANAGEMENT AND BIOIVERSITY CONSERVATION** Ethics and environment; Policy and legal aspects of environment management- Environmental Policies and Programmes in India, Environment laws and legislations; Environmental impact assessment (EIA); EIA documentation and process; Environmental auditing; Life cycle assessment; Biosphere reserves and Ecosystem Conservation, International initiatives for biodiversity management, biodiversity hotspots and initiatives	**08**	**CO5**

SELF-STUDY COMPONENT:

UNIT 1 : Case studies of Indian and international cities in green technology
UNIT 2:.Global developments and examples of waste to energy plants
UNIT 3: Terrestrial, geological and ocean carbon sequestration
UNIT 4: Future potential of fuel cells
UNIT 5: Biotechnological processes for bioresources assessment, BT in ex situ conservation of Biodiversity.

NOTE:

1) Questions for CIE and SEE not to be set from self-study component.
2) Assignment Questions should be from self-study component only.

TEXT BOOKS:

1) Handbook of Solid Waste Management and Waste Minimization Technologies by Nicholas P. Cheremisinoff.
2) Introduction To Carbon Capture And Sequestration. Smit BerendReimer Jeffrey AOldenburg Curtis M, 2014,World Scientific. ISBN:9781783263301.
3) Carbon Capture and storage: R&D Technology for Sustainable Energy future By Malti Goel
4) The Hydrogen Economy Opportunities and Challenges by Michael Ball and Martin Wietschel.
5) Fuels from Waste (Energy science and engineering) Editor-Larry L. Anderson; Editor-David A. Tillman;Academic Press Inc.ISBN 10: 0120564505 ISBN 13: 9780120564507 .1978
6) Environmental Biotechnology by Pradipta Kumar Mahopatra. ISBN-10: 818823754X ; ISBN-13: 978-8188237548.2007.

REFERENCE BOOKS:

1) IPCC (Intergovernmental for Climate Change). Climate Change: Mitigation. Contribution of Working Group III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change
2) Hydrogen and Fuel Cells by Sorensen, B.
3) Solid Waste Engineering by P. Aarne Vesilind, William A. Worrell and Debra R. Reinhart.

WASTE MANAGEMENT

Sub Code: 18CH7IEWSM	**Credits: 03**
L: T: P: S: 3: 0: 0: 0	**CIE Marks: 50**
Exam Hours: 03	**SEE Marks: 50**
Total hours: 40	

OBJECTIVES:

1) Definition of waste water and solid waste, their sources and characteristics and its effects on the environment.
2) Types of treatment and principles of Physical, chemical and biological treatment methods.
3) Quantification of solid waste, its collection, management and transformation of it to useful products

COURSE OUTCOMES:

After completion of the course, the graduates will be able to:

CO1	Apply Physical and Chemical treatment methods to control pollution in water
CO2	Differentiate among different biological treatment methods
CO3	Determine factors influencing the aerobic processes
CO4	Implement Solid Waste Management Techniques
CO5	Discriminate between different solid waste reducing techniques
CO6	Apply engineered land filling techniques

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	2	-	0	2	1	-	1	-	1
CO2	3	2	3	2	-	0	2	1	-	1	-	1
CO3	3	2	2	1	-	0	2	1	1	1	-	1
CO4	2	3	3	2	-	0	2	1	-	1	-	1
CO5	3	3	2	2	-	0	2	1	1	1	-	1
CO6	2	3	3	2	-	0	2	1	1	1	1	1

COURSE CONTENTS

UNIT	Course Content	Hrs
1	**Introduction to Waste water**: Standards, Act Physical Treatment Methods: Introduction to Screening, flow equalization, flocculation, Grit removal, sedimentation. **Chemical Treatment Methods:** Introduction to coagulation, precipitation, oxidation, Neutralization, chlorination. Study on phosphorous and heavy metals removal.	**10**
2	**Biological Treatment:** Introduction to Bacterial life cycle, cell culturing, types of biological processes. **Anaerobic Process**: Construction and working of UASBR, Rotating biological contactors. Algal ponds	**07**
3	**Aerobic process**. Theory of aeration, factor affecting oxygen transfer, Mixing requirements, types of aerators. Nitrification & Denitrification. Detailed study on Activated sludge process & Trickling filter	**07**
4	**Solid waste Management:** Integrated solid waste management, Measures and methods to assess solid waste quantities. Functional elements, Generation of solid waste, Onsite handling. Collection & Transportation	**08**
5	**Solid Waste reduction & Source reduction &3R's Transformation:** Pyrolysis, Gasification, waste to energy, composting. **Disposal**: Site selection, landfill and engineering landfill, Leachate and gas collection	**08**

SELF-STUDY COMPONENT:

1) Status of Water quantities for different purposes worldwide. Sources of water in India.

2) Knowledge of wetlands oxidation ponds.
3) Construction & working of rotating biological contactor.
4) Comparison of solid waste generation quantities in developed & developing countries.
5) Case study on solid waste management in cities.

NOTE:

1) Questions for CIE and SEE not to be set from self-study component.
2) Assignment Questions should be from self-study component only.

TEXT BOOKS:

1) Arecivala S J, and S R Asolekar, Wastewater Treatment for Pollution Control and Reuse, 3rd Edition, ISBN- 13-978-0-07-062099-5, Tata McGraw Hill Pvt Ltd., New Delhi, 2009.
2) George Tchobanoglous et al, Integrated Solid Waste Management, 2nd Edition, ISBN 10.0070632375 McGraw Hill Book Company, New York, 1993.
3) C S Rao Environmental Pollution Control and Engineering, ISBN 0470217634 New age international Pvt Ltd, New Delhi, 2009.

REFERENCE BOOKS:

1) Jagbir Singh and A L Ramanathan (Eds), Solid Waste Management- Present and Future Challenges, ISBN 9380026420, I K International House Pvt Ltd., New Delhi, 2010.
2) Metcalf and Eddy, Wastewater Engineering-Treatment, Disposal & Reuse, ISBN 0070418780, Tata McGraw Hill, Book Company, New Delhi, 1991.
3) H E Babbilt and R Baumann, Sewage and Sewage Treatment, ISBN 0-07-112250-81986.
4) Martell, Solid Wastes, John Wiley & sons, New York, 1975.
5) Frank Krieth, Handbook of Solid Waste, ISBN 0071500340 McGraw Hill Inc., New York, 1996

URBAN WASTE HANDLING AND DISPOSAL

Sub Code: 18CV7IEUHD	**Credits: 03**
L: T: P: S: 3: 0: 0: 0	**CIE Marks: 50**
Exam Hours: 03	**SEE Marks: 50**
Total hours: 40	

OBJECTIVES:

1) To study the effects of the various types of waste on human being, animals and environment.
2) To study the water &wastewater management and solid waste of urban area.
3) To study the various techniques and options for handling industrial wastewater, hazardous waste and air pollution of urban area.

COURSE OUTCOMES:

After completion of the course, the graduates will be able to:

CO1	To evaluate the effects of various wastes on human beings, animals and on Environment.
CO2	To solve the water and wastewater treat by using conventional and advanced treatment methods.
CO3	To estimate quantity of solid waste, E-waste and biomedical wastes and to suggest their disposal methods.
CO4	To suggest reuse and recycles techniques of solid waste, E-waste and biomedical wastes and to suggest their disposal methods.

CO5	To characteristics and to select treatment options for selected industrial wastewater.
CO6	To discuss the impacts of hazardous waste and air pollution.

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1									
CO2	3	3	1									
CO3	3	1	1									
CO4	3	3	1									
CO5	3	1	2									
CO6	3	1	2									

COURSE CONTENTS

UNIT	Course Content	Hrs	COs
1	**Introduction** Definition of waste, types and sources of waste, properties of water, wastewater and air, effects on Human beings and animals and on their environment, introduction to various acts and rules for waste in India	6	CO1
2	**Domestic Water and Wastewater Management:** Importance of water and wastewater treatment, water quality standards, effluent standards, Flow diagram of water and wastewater treatment, Advanced wastewater treatments-RO, Nitrification and De-nitrification process, SBR techniques	8	CO2
3	**Solid Waste Management:** **Municipal waste-** Types, sources, collection, transportation and disposal methods **Biomedical waste-** Types, sources, collection and disposal methods **E-waste** –Composition, segregation, Reuse and recycle and disposal techniques **Construction and Demolition Waste-** Problems of collection, Segregation, transportation & limitations, Reuse and disposal of waste	10	CO3 CO4
4	**Industrial wastewater management:** Volume and strength reduction, equalization, neutralization, Propagation techniques Flow diagram and treatment methods for pulp and paper, dairy, sugar & textile industries	8	CO5
5	**Hazardous waste and Air pollution management**: Definition of hazardous waste, classification of waste, processing techniques, rules and regulation of disposal of waste Sources of air pollution, formation of acid rain, Causes of acid rain for environment and its control, green houses gasses and global warming, air pollution in Indian Scenario	8	CO6

SELF-STUDY COMPONENT:

Module	Contents	CO's
1	Acts and rules for water, wastewater and air pollution in India	CO1
2	Acts and rules for Biomedical waste- and E-waste disposal	CO3
3	Rules and regulation of disposal of hazardous waste	CO6
4	Air pollution in Indian Scenario	CO6

NOTE:

1) Questions for CIE and SEE not to be set from self-study component.
2) Assignment Questions should be from self-study component only.

TEXT BOOKS:

1) Environmental Engineering: Howard S. Peavy, Donald R. Rowe, George Tchnobanoglous McGraw Hill International Edition.
2) Industrial Waste Water Treatment.-Rao MN, and Dutta A.K.
3) Hazardous Waste Management-Charles A. Wentz - 1998
4) Air Pollution M N Rao, H V N Rao Air Pollution Tata McGraw-hills Publishers, New Delhi,

REFERENCE BOOKS:

1) Integrated solid waste management-Engineering principles and management issues George Tchobanoglous, Hilary Theisen, S. A. Vigil McGraw-Hill,
2) E-waste: Implications, regulations, and management in India and current global best practices by Rakesh Johri

INTRODUCTION TO MACHINE LEARNING

Sub Code: 18CS7IEIML	**Credits: 03**
L: T: P: S: 3: 0: 0: 0	**CIE Marks: 50**
Exam Hours: 03	**SEE Marks: 50**
Total hours: 40	

COURSE OUTCOMES:

After completion of the course, the graduates will be able to:

CO1	Understand and analyze various of Machine Learning Algorithms
CO2	Analyze relationship between Mathematical Models and underlying Algorithms
CO3	Recognize and implement the ways of selecting suitable parameters for various ML Techniques
CO4	Integrate libraries and statistical tools with recent technologies to develop complete models
CO5	Evaluate the Models generated from data effectively
CO6	Apply ML Algorithms to the real time scenarios and solve the problems efficiently.

COURSE CONTENTS

UNIT	Course Content	Hrs	COs
1	Introduction to Machine Learning: Supervised Learning, Unsupervised Learning Reinforcement Learning (overview only), Inductive Bias-Variance, Regression: Linear and Logistic Regression, Classification: Linear classification	8	CO1
2	Decision Trees: Introduction, Pruning, Loss functions, Categorical attributes, Multiway splits, Examples, Entropy Analysis	8	CO2
3	Clustering: Partitional Clustering, Hierarchical Clustering, Birch algorithm, CURE algorithm, Density based clustering	8	CO3& CO4
4	Artificial Neural Networks (ANNs): Introduction, Neural Network representation, Appropriate Problems, Perceptrons, Stochastic Vs Non-Stochastic gradient descent, Back propagation algorithm	8	CO5

5	Bayesian Networks: Introduction, Bayes Theorem, Naive Bayes classifier, Bayesian belief networks, EM algorithm	8	CO6

NOTE:

1) Questions for CIE and SEE not to be set from self-study component.
2) Assignment Questions should be from self-study component only.

TEXT BOOKS:

1) Tom M Mitchell, Machine Learning, India Edition July 2017, McGraw Hill Education.
2) Pattern Recognition and Machine Learning by Christopher Bishop.
3) EthemAlpaydin, Introduction to Machine Learning, Second Edition, MIT Press.

REFERENCE BOOKS:

1) The elements of Statistical Learning, by Trevor Hastie, Robert Tibshirani,Jerome H Friedman.
2) Stephen Marsland, Machine Learning-An algorithmic Perspective, CRC Press.

BUILDING SCIENCE

Sub Code: 18CT7IEBIS	**Credits: 03**
L: T: P: S: 3: 0: 0: 0	**CIE Marks: 50**
Exam Hours: 03	**SEE Marks: 50**
Total hours: 40	

OBJECTIVES:

1) To understand different climatic factors of India
2) To understand the airflow patterns in and around buildings
3) To understand the heat exchange in buildings through conduction, convection and
4) radiation
5) To understand different acoustic design consideration in buildings
6) To understand the meaning of embodied energy and operational energy
7) To understand the different lights used in buildings

COURSE OUTCOMES:

After completion of the course, the graduates will be able to:

CO1	To understand the requirements & necessity of building services
CO2	To define advanced building services terminologies
CO3	To illustrate alternative energy conservation measures in terms of energy
CO4	management, cost assessment and codes of practice and standards
CO5	To explain the basic concepts of climatic factors
CO6	To explain the various technologies required for building services

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	-	-	-	-	-	-	-	-	-	3
CO2	3	-	-	-	-	-	-	-	-	-	-	2
CO3	3	3	-	-	-	1	3	3	-	-	-	3

CO4	3	-	-	-	-	-	2	-	-	-	-	2
CO5	3	2	-	-	-	-	-	-	-	-	-	2
CO6	3	3	-	-	-	-	-	3	-	-	-	2

COURSE CONTENTS

Unit	CONTENTS	HRS	CO
1	Climatic factors, Classification of tropical climates, site climate, micro climate of human settlements, Sun-Earth Relationship, Sun path diagram, solar geometry	**8**	4
2	Necessity of ventilation, health and comfort ventilation, systems of ventilation, factors affecting ventilation, air flow patterns in buildings.	**8**	1, 2
3	Thermal comfort factors, thermal indices, thermal quantities, heatexchange in buildings, periodic heat flow, mechanical and structuralmeans of thermal Control.	**8**	3
4	Propagation of sound, sound insulation, absorption, transmission,reverberation, roofing and walling system for sound absorption andinsulation, noise and noise control in buildings.Principles of daylighting in buildings, laws of illumination, introduction to various types of lamps.	**8**	3, 4, 5
5	Energy in buildings- Embodied energy, operational energy,sustainability, energy conservation in buildings. Energy efficientmaterials and Technologies, Green building concepts, ratingstandards – case studies.	**8**	6

SELF-STUDY COMPONENT:

Module 1:Construction in various condition & regions
Module 2:Artificial & Natural Ventilation
Module 3: Exhaust Systems in buildings
Module 4: Insulation materials for buildings
Module 5: Primary Energy use in institutional & public buildings.

NOTE:

1) Questions for CIE and SEE not to be set from self-study component.
2) Assignment Questions should be from self-study component only.

TEXT BOOKS:

1) Koenigsberger, “Manual of Tropical Housing and Building- Climatic Design”, Orient Longman
2) Deodhat, S V, “Building Science and Planning”, Khanna Publication.

REFERENCE BOOKS:

1) B C Punmia, “Building Construction”, Laxmi Publication
2) SP: 41- Functional Requirements for Buildings, BIS, New Delhi

ENERGY CONSERVATION AND MANAGEMENT

Sub Code: 18EE7IEECM	**Credits: 03**
L: T: P: S: 3: 0: 0: 0	**CIE Marks: 50**

Exam Hours: 03	SEE Marks: 50
Total hours: 40	

OBJECTIVES:

1) To make the students understand with the basic concepts of energy sources and energy conservation.
2) To discuss the energy auditing, energy cost and financial analysis.
3) To summarise the efficient electrical utility and green energy.

COURSE OUTCOMES:

After completion of the course, the graduates will be able to:

CO1	To Identify the basic issues in energy consumption and conservation across the world.
CO2	To analyze energy management, cost and financial concepts.
CO3	To illustrate the different electrical utilities for efficient energy system.
CO4	To summarize the various green energy systems for proficient energy conservation.

COURSE CONTENTS

UNIT	Course Content	Hrs	COs
1	**Energy scenario** Indian Energy Scenario – Types & Forms of Energy – An overview of energy consumption and its effects – Reasons to save energy (financial and environmental) - Energy Conservation Acts and related policies– Schemes of Bureau of Energy Efficiency (BEE)	8	CO1
2	**Energy auditing and Management** Definition & objective of Energy management. Organizational background desired for energy management, Energy audit and analysis phase, implementation phase. Case studies of energy audit in different industries. Energy management strategies for industry.	8	CO1, CO2
3	**Energy costs and financial analysis** Understanding Energy Costs – Benchmarking and Energy Performance – Fuel and Energy Substitution – Material Balances – Energy Balances– Financial techniques for assessing energy conservation measures – Fixed and variable cost – Interest charges – Simple payback period – Net Present Value - Discounted cash flow method.	8	CO1, CO2
4	**Energy Efficiency in Electrical Utilities** Fans & blowers – Compressed air systems – Refrigeration and air conditioning systems - Pumps & pumping systems – Lighting systems – Energy efficient technologies in electrical systems.	8	CO1, CO3
5	**Green Energy:** Introduction to Green energy concept, Importance and benefits of green energy, Solar Energy Systems, Role of Green Building in Energy Conservation, solar lighting, Solar building heating and cooling systems- Solar thermal storage wall, solar green house, solar roof ponds. Biomass boilers, biomass stoves, ground source heat pumps, solar thermal heating, and heat bank thermal store.	8	CO4

SELF-STUDY COMPONENT:

1) Importance and role of energy management, Energy economics, Payback period, Internal rate of return, life cycle costing.
2) Co-generation of energy, Electricity Billing –Components & Costs.

NOTE:

1) Questions for CIE and SEE not to be set from self-study component.
2) Assignment Questions should be from self-study component only.

TEXT BOOKS:

1) Patrick, Dale R - Energy conservation guidebook-The Fairmont Press (2014)
2) Giovanni Petrecca (auth.) - Energy Conversion and Management_ Principles and Applications-Springer International Publishing (2014)
3) Paloma Carden - Advances In Energy Conservation -World Technologies (2011)
4) W.C. Turner, Energy Management, Hand Book.

REFERENCE BOOKS:

1) Smith CB (2015) Energy Management Principles, Pergamon Press, New York.
2) Charlie G. Wing - The Visual Handbook of Energy Conservation. A Comprehensive Guide to Reducing Energy Use at Home-Taunton Press (2013)

GPS & IT'S APPLICATIONS

Sub Code: 18EC7IE2GA	**Credits: 03**
L: T: P: S: 3: 0: 0: 0	**CIE Marks: 50**
Exam Hours: 03	**SEE Marks: 50**
Total hours: 40	

OBJECTIVES:

1.	Understanding general concepts of a satellite navigation system.
2.	Acquire knowledge about various regional and global Navigation Satellite Systems (NSS).
3.	Acquire knowledge about concepts used in a Navigation Satellite Systems.
4.	Detailed understanding of GPS system and its structure.
5.	Gain knowledge about general GPS applications.
6.	Gain knowledge about government and military applications of GPS

COURSE OUTCOMES:

After completion of the course, the graduates will be able to:

CO1	Discuss about GPS and other Navigation Satellite Systems.
CO2	Apply the positioning equation to find the position of user.
CO3	Describe signals, coordinate systems and GPS receiver operation.
CO4	Predict various losses influence GPS accuracy.
CO5	Decide whether GPS can be used in an application.
CO6	Elaborate role of GPS in various applications.

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	-	-	-	-	-	-	-	-	-	-
CO2	3	2	1	-	-	-	-	-	-	-	-	-
CO3	3	2	1	-	-	-	-	-	-	-	-	-
CO4	3	2	-	-	-	-	-	-	-	-	-	-

CO5	3	2	-	-	-	-	-	-	-	-	-	-
CO6	3	2	-	-	-	-	-	-	-	-	-	-

COURSE CONTENTS

UNIT	Course Content	Hrs	COs
1	**MODULE 1** Introduction, basic terminologies of satellite systems, Need for GPS, GPS Program History, GPS constellation, GPS Satellite Orbits, GPS satellites, GPS services, GPS system segments, Types of GPS receivers. Fundamentals of Satellite Navigation, Concept of Ranging Using TOA Measurements,	8	CO1 CO2
2	**MODULE 2** Principle of Position Determination Via Satellite-Generated Ranging Signals, Position Determination Using PRN Codes, Determining Satellite-to-User Range, Calculation of User Position, Obtaining User Velocity, GPS signals: C/A Code, P code, GPS data format, GPS (code based and carrier based) measurement's, GPS signal generation, GPS **receiver**: Basic GPS receiver operations (Only theoretical concepts), GPS errors.	8	CO2 CO3 CO4
3	**MODULE 3** Reference Coordinate Systems, Earth-Centered Inertial Coordinate System, Earth-Centered Earth-Fixed Coordinate System, World Geodetic System, time systems: UTC, GPS System Time, Navigation and Surveying using GPS, Differential GPS, other GNSS systems: GLONASS, GALILEO, QZSS, BEIDOU, IRNSS (Only details of system)	8	CO1 CO3
4	**MODULE 4** General Applications of GPS: GPS for the Utilities industry, Forestry and natural resources, Precision farming, Civil engineering applications, Monitoring structural deformations, Open-pit mining, Land seismic surveying, Marine seismic surveying, Airborne mapping, Seafloor mapping, Vehicle navigation, Transit systems, Retail industry, Cadastral surveying, stakeout (waypoint navigation).	8	CO5 CO6
5	**MODULE 5** Government and Military Applications of GPS: Marine Navigation, Air Navigation, Land Navigation GPS in Surveying, GPS in Mapping: Geographical Information Systems. Differential Applications and Services of GPS: Precision Approach Aircraft Landing Systems, Attitude Determination Systems, GPS in Telematics and LBS, Military User Equipment—Aviation, Shipboard, and Land, Autonomous Receivers—Smart Weapons	8	CO5 CO6

SELF-STUDY COMPONENT:

Module 1 : Kepler's laws and two body motion
Module 2 : PRN sequences, C/A code generation
Module 3 : Other time systems, Assisted GPS
Module 4 : GPS receivers used for various applications
Module 5 : Technical details of Military GPS receivers

NOTE:

1) Questions for CIE and SEE not to be set from self-study component.
2) Assignment Questions should be from self-study component only.

TEXT BOOKS:

1) Ahmed El-Rabbany, Elliott D. Kaplan Christopher J. Hegarty, "Understanding GPS Principles and Applications", Second Edition, Artech House, Inc., 2006, ISBN 1-58053-894-0, 2010.
2) "Introduction to GPS-The Global Positioning System", Artech House, ISBN 1-58053-183-0, 2010.
3) Bruce R. Elbert, "Introduction to Satellite Communication", 3rd Edition, Artech House, UK, 2008.

REFERENCE BOOKS:

1) Timothy Pratt, Charles Bostien, Jeremy Allnut, "Satellite Communications", 2nd edition, John Wiley Pvt. Ltd & Sons Publications, 2008.
2) James Bao-Yen Tsui, "Fundamentals of Global Positioning System Receivers", Second Edition, A John Wiley & Sons, Inc., Publication.

On-Line Materials & Resources (NPTEL courses / Video lectures / You-tube Videos / Power points / On-line notes / web-links :

1. https://www.gps.gov/systems/gnss/
2. https://youtu.be/kHOsM9dGTEA
3. https://insidegnss.com/
4. https://gnss-sdr.org/

Scheme of Evaluation of the CIE & Assessment Pattern :

Assignment : Only one assignment (open book test normally) will be of 10 marks & conducted in the class during the course of the semester (normally midway thro' the semester or in between 2nd & 3rd test). Generally, 2- 4 questions can be given which has to be solved in 1 hour duration, the assignment question has to be from the self-study component or it can be a coding demo done in the laptop & shown on the spot to the teacher in the class.

Quiz : There will be 1 quiz of 30 questions of 1 marks each, which will be reduced to 10 marks, which may be conducted along with the 2nd CIE test or at the appropriate time during the course of the semester.

CIE : There will be 3 CIE tests in a semester conducted for 50 marks with 10 Marks MCQs, remaining 40 Marks descriptive (with theory & problems), each of 10 Marks, each CIE will be reduced to 10 Marks and totalled up for 30 Marks. There will be choices in the descriptive questions.

TOTAL QUALITY MANAGEMENT

Sub Code: 18IM7IETQM	**Credits: 03**
L: T: P: S: 3: 0: 0: 0	**CIE Marks: 50**
Exam Hours: 03	**SEE Marks: 50**
Total hours: 40	

OBJECTIVES:

1) To understand the Total Quality Management concept and principles and the various tools available to achieve Total Quality Management.
2) To understand the statistical approach for quality control.
3) To understand the various models of TQM.

COURSE OUTCOMES:

After completion of the course, the graduates will be able to:

CO1	Explain the various quality control and six sigma concepts for organizations
CO2	Apply continuous improvement model to satisfy the customers
CO3	Determine process control, proactive, reactive methods to improve the quality of the product
CO4	Execute appropriate TQM frame work for organization continuous improvement
CO5	Implement hoshin management and societal networking concepts in an organization
CO6	Develop total participation methods to satisfy internal and external customer

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	3	3					2	2	1	1	3
CO2	2	2	2					2	2	1	1	1
CO3	2	2	2					2	2	1		1
CO4	2		2					2	3	2		2
CO5	2		2					2	3	2		1
CO6	2	1	2					2	3	1		1

COURSE CONTENTS

UNIT	Course Content	Hrs	COs
1	**OVERVIEW OF TOTAL QUALITY MANAGEMENT:**. Axioms of TQM, contributions of Quality Gurus – Deming's approach, Juan's quality trilogy, Crosby and quality treatment, Imai's Kaizen, Ishikawa's company-wide quality control, and Fegenbaum's theory of TQC, QFD. **EVOLUTION OF QUALITY CONCEPTS AND METHODS:** Quality concepts. Development of four finesses, evolution of methodology, evolution of company integration, quality of conformance versus quality of design from deviations to weaknesses to opportunities. Future fitness's, four revolutions in management thinking, and four levels of practice	08	CO1, CO2
2	**CONTINUOUS IMPROVEMENT:** Improvement as problem solving process; Management by process, WV model of continuous improvement, process control, process control and process improvement, process versus creativity. Reactive Improvement; Identifying the problem, standard steps and tools, seven steps case study, seven QC tools. **PROACTIVE IMPROVEMENT:** Management diagnosis of seven steps of reactive improvement. Proactive Improvement; Introduction to proactive improvement, standard steps for proactive improvement, semantics, example-customer visitation, Applying proactive improvement to develop new products- three stages and nine steps.	08	CO1 CO2

3	**TOTAL PARTICIPATION:** Teamwork skill. Dual function of work, teams and teamwork, principles for activating teamwork, creativity in team processes, Initiation strategies, CEO involvement Example strategies for TQM introduction. Infrastructure for mobilization. Goal setting (Vision/Mission), organization setting, training and education, promotional activities, diffusion of success stories, awards and incentives monitoring and diagnosis, phase-in, orientation phase, alignment phase, evolution of the parallel organization.	08	CO3 C04
4	**HOSHIN MANAGEMENT:** Definition, phases in hoshin management-strategic planning (proactive), hoshin deployment, controlling with metiers (control), check and act (reactive). Hoshin management versus management by objective, hoshin management and conventional business planning, an alternative hoshin deployment system.	08	CO5
5	**SOCIETAL NETWORKING:** Networking and societal diffusion – Regional and nationwide networking, infrastructure for networking, change agents, Centre for quality Management case study, dynamics of a societal learning system. TQM as learning system, keeping pace with the need for skill, a TQM model for skill development, summary of skill development.	08	CO6

SELF-STUDY COMPONENT:

UNIT 1: History of TQM
UNIT 2: General guidelines for management diagnosis of a QI story, Discussion on case Study for diagnosis of the seven steps.
UNIT 3: Diffusion of success stories
UNIT 4: Hoshin management as "systems Engineering" for alignment.
UNIT 5: Openness with real cases

NOTE:

1) Questions for CIE and SEE not to be set from self-study component.
2) Assignment Questions should be from self-study component only.

TEXT BOOKS:

1) **A New American TQM Four Practical Revolutions in Management** - Shoji Shiba, Alan Graham and David Walden – Productivity Press, Portlans (USA) -1993..
2) **Management for Total Quality** - N Logothetis- Prentice Hall of India, New Delhi - 1994. (1st Chapter)

REFERENCE BOOKS:

1) **The Quality Improvement Hand Book** -Roger C Swanson - Publisher Vanity Books International, New Delhi - 1995.
2) **Quality Management** - Kesavan R - I K International Publishing house Pvt. Ltd – 2008.

DATABASE MANAGEMENT SYSTEMS

Sub Code: 18IS7IEDBS	**Credits: 03**
L: T: P: S: 3: 0: 0: 0	**CIE Marks: 50**
Exam Hours: 03	**SEE Marks: 50**
Total hours: 40	

OBJECTIVES:

1) Know the fundamentals of database management systems, transactions and related concepts
2) Study E-R model and relational model for designing database.
3) Understand normalization techniques for good database design.
4) Learn writing SQL queries for the given requirements.

COURSE OUTCOMES:

After completion of the course, the graduates will be able to:

CO1	Gain knowledge on database management systems, transactions and related concepts.
CO2	Apply E-R and relational modeling techniques for designing database.
CO3	Design good database using normalization techniques.
CO4	Gain skills in writing queries using SQL for the given requirements.
CO5	Understand basic issues of transaction processing and concurrency control.
CO6	Evaluate a business situation and designing & building a database applications

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	-	-	-	-	-	-	-	-	-	-
CO2	3	2	1	-	-	-	-	-	-	-	-	-
CO3	3	2	-	-	-	-	-	-	-	-	-	-
CO4	3	2	-	-	-	-	-	-	-	-	-	-
CO5	3	2	-	-	-	-	-	-	-	-	-	-
CO6	3	2	2	-	-	-	-	-	-	-	-	-

COURSE CONTENTS

UNIT	Course Content	Hrs	COs
1	**Introduction:** Characteristics of Database approach; Actors on the scene; Workers behind the scene; Advantages of using DBMS approach; When not to use DBMS; Data models, schemas and instances; Three schema architecture and data independence; Database languages and Interfaces, Database System environment, Centralized and Client/Server architectures for DBMSs, Classification of Database management systems.	**8**	**CO1**
2	**Entity-Relationship model**: Entity types, Entity Sets, Attributes and Keys; Relationship types, Relationship Sets, Roles and structural Constraints; Weak Entity types; ER Diagrams, Naming Conventions and Design issues; Relational Database Design Using ER-to-Relational mapping.	**8**	**CO2 CO6**
3	**Relational Model and SQL:** Relational Model Concepts; Relational Model constraints and Relational Database Schemas; update operations. SQL data definition and data types, Specifying constraints in SQL, Basic retrieval queries in SQL; Insert, Delete and Update statements in SQL; More complex SQL retrieval queries, Views (Virtual Tables) in SQL; Schema change statements in SQL.	**8**	**CO4**
4	**Relational Algebra**: Unary Relational Operations; SELECT and PROJECT; Relational Algebra Operations from Set Theory; Binary Relational Operations: JOIN and DIVISION; Additional Relational Operations; Examples of Queries in Relational Algebra.	**8**	**CO3**

5	**Database Design:** Informal Design Guidelines for Relation Schemas; Functional Dependencies; Normal Forms Based on Primary Keys; General Definitions of Second and Third Normal Forms; Boyce-Codd Normal form, Multivalued Dependency and Fourth Normal Form. Transactions and schedules.	**8**	**CO3 CO5**

SELF-STUDY COMPONENT:

UNIT 1: A brief history of database applications; Using High-Level Conceptual Data Models for Database Design
UNIT 2: An Example Database Application; Relational Algebra Operations from Set Theory; Examples of Queries in Relational Algebra
UNIT 3:Database programming issues and techniques; Embedded SQL, Dynamic SQL; Database stored procedures and SQL / PSM, More complex SQL Queries
UNIT 4: Algorithms for Relational Database Schema Design
UNIT 5: Introduction to ARIES; Recovering from a System Crash; Media Recovery.

NOTE:

1) Questions for CIE and SEE not to be set from self-study component.
2) Assignment Questions should be from self-study component only.

TEXT BOOKS:

1) Elmasri and Navathe, Fundamental of Database Systems, 6th Edition, Addison- Wesley, 2011.
2) Silberschatz, Korth and Sudharshan, Database System Concepts, 6th Edition, McGrawHill, 2015.

REFERENCE BOOKS:

1) Hector Garcia-Molina, Jeffrey D. Ullman, Jennifer Widom, Database Systems: The Complete Book ,Second edition, Pearson, 2013.
2) SeemaKedar, Database Management Systems-A Conceptual Approach Technical Publications, 2014

SAFETY INSTRUMENTATION

Sub Code: 18EI7IESAI	**Credits: 03**
L: T: P: S: 3: 0: 0: 0	**CIE Marks: 50**
Exam Hours: 03	**SEE Marks: 50**
Total hours: 40	

OBJECTIVES:

1) To identify, classify and maintain the different Safety Instrumented System
2) To compare the specific zones in Process Instrumentation
3) To understand the working of safety instrumentation system
4) To describe the working of various types of reports for maintenance
5) To define risk with reference to safety integrated system

COURSE OUTCOMES:

After completion of the course, the graduates will be able to:

CO1	Describe the terms associated with Safety Instrumentation Systems.

CO2	Classify the various types of zones to hazard and safety process in instrumentation and control.
CO3	Describe Safety Integrated Level - 0 to Safety Integrated Level -4.
CO4	Compare Safety Integrated Function, Safety Integrated System and Safety Integrated Level.
CO5	Identify the types of protection system maintenance program PSMP.
CO6	Analyze the protection system failures as report and action.

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	-	-	2	2	-	-	-	-	2
CO2	3	3	3	-	-	2	2	-	-	-	-	2
CO3	3	3	3	-	-	2	2	-	-	-	-	2
CO4	3	3	3	-	-	2	2	-	-	-	-	2
CO5	3	3	3	-	-	2	2	-	-	-	-	2
CO6	3	3	3	-	-	2	2	-	-	-	-	2

COURSE CONTENTS

UNIT	Course Content	Hrs	COs
1	**INSTRUMENTATION SAFETY IN PROCESS APPLICATIONS** With guiding standard of IEC 61421.10 and IEC 60079.10 for Types of Zones of Processes in NFPA 497/API 500 - Dust zones- Gas / Vapor groups- Equipment Protection Level (EPL)- Common Materials within Associated Class and Group Ratings- Equipment protection system, Emergency shutdown system, Safety critical system, Interlock (engineering)- Reliability regimes- Software engineering for life critical systems	6	CO2
2	**SAFETY INSTRUMENTED SYSTEM (SIS)** Safety Instrumentation systems terms – Hazard and Operability, Failure Modes, Effects and Criticality Analysis, Probability of Failure on Demand, Failure Mode and Effective Analysis, Safety Instrumented Function, Process Hazard Analysis, High Integrity Process Pressure System, Safety Life Cycle, Safety Requirement Specifications.	10	CO1
3	**SAFETY INTEGRATED LEVEL (SIL)** Safety Integrated Level SIL 0 / None – SIL1 –SIL 2-SIL 3-SIL 4 - RISK Interrelationship Between SIL, PFD avg, Availability, and Consequence - RISK Analysis and SIL-SIL Determination Techniques - Comparison of Various SIL Determination Methods.	10	CO3
4	**SAFETY INSTRUMENTED FUNCTION(SIF) AND SAFE FAILURE FRACTION(SFF) IN FIELD, UTILITY AND SIM** Safe Failure Fraction (SFF) – Safety Instrumented Function (SIF) –Hazard, Mode of operation, Detection, Decision, Action - Safe state, Response time, Proof –test interval, Spurious trip rate	6	CO4
5	**OPERATION, MAINTENANCE, TESTING, REPORTING AND MANAGEMENT OF PSMP** Reports/Records – Protection System Maintenance Program – Self Monitoring Capabilities and Limitations-Notifications of Protection Systems Failures. Safety standards in various industries.	8	CO5, CO6

SELF-STUDY COMPONENT:

Module 3: Layers of Protection Analysis (LOPA), Fault Tree Analysis(FTA), Risk Graph,Safety Matrix.
Module 5: Primary and secondary functions and responsibility of maintenance department.

NOTE:

1) Questions for CIE and SEE not to be set from self-study component.
2) Assignment Questions should be from self-study component only.

TEXT BOOKS:

1) Goettsche. ISA Maintenance of Instruments and Systems, 2nd Edition, ISA, 2005.
2) Williams M. Goble, Control system safety evaluation and reliability, third edition, ISA, 2010.
3) Harry Cheddie, William M. Goble, Safety Instrumented Systems Verification: Practical Probabilistic Calculation, ,ISA,2005.

REFERENCE BOOKS:

1) Alan McMillan, **Electrical Installations in Hazardous Areas**, Butterworth-Heineman ,1998.
2) Lindley R. Higgins, R. Keith Mobley, Darrin Wyckoff, **Maintenance Engineering Handbook,** 7th Edition, 2008.
3) Jones E. B. **Instrument Technology, Vol - I, II**, Holly well, third edition, 1974.

INDUSTRIAL DESIGN AND ERGONOMICS

Sub Code: 18ME7IEIDE	**Credits: 03**
L: T: P: S: 3: 0: 0: 0	**CIE Marks: 50**
Exam Hours: 03	**SEE Marks: 50**
Total hours: 40	

COURSE OUTCOMES:

After completion of the course, the graduates will be able to:

CO1	To understand the principles of industrial design and ergonomics in engineering applications.
CO2	To optimize resources utilization by improving productivity and to eliminate unproductive activities under the control of the Engineers for designing the products and processes.
CO3	To enable the students to understand the concept of unity, order and expressions in aesthetics of product design.
CO4	To understand the influence of line and form on human psychology and the effect of colours on the engineering equipments impacting the workers.
CO5	To apply the concept of shapes and sizes of various displays in machineries and automobiles.
CO6	To enable the students to understand the importance of anthropomorphic data and its application in industrial design

COURSE CONTENTS

UNIT	Course Content	Hrs

1	**Module –I** **Industrial Design and Ergonomics:** Introduction: An approach to industrial design, elements of industrial design, structure for industrial design in engineering application in modern manufacturing systems. Introduction to Ergonomics, general approach to the man machine relationship, work station design, working position.	**8**
2	**Module –II** **Productivity & Work Study:** Definition of productivity, factors affecting productivity, objective & scope of work study, human factors in work study, work study & management, work study & supervisor, work study & worker. **Industrial Design In Practice:** General design, specifying design equipments, rating the importance of industrial design, Industrial design in the design process.	**8**
3	**Module –III** **Aesthetic Concepts** Concept of unity, Concept of order with variety, Concept of purpose style and environment, Aesthetic expressions. Style components of style, house style, observations style in capital goods. Applications of Ergonomics for Civil Engg., Architecture, Industrial applications. Application of Ergonomic to Computer/ Electronics component design.	**8**
4	**Module –IV** **Visual Effect Of Line And Form** The mechanics of seeing, psychology of seeing, general influences of lined and form. Colour: Colour and Light, Colour and Objects, Colour and the eye, Colour consistency, Colour terms, reaction to colour and colour continuation, colour on engineering equipments.	**8**
5	**Module –V** **Control And Display:** Shapes and Sizes of various controls and displays, multiple displays and control situation, design of major controls in automobiles, machine tools etc, design of furniture, design of instruments. **Ergonomics and Production:** Ergonomics and product design, ergonomics in automated systems expert systems for ergonomics, anthropomorphic data and its applications in ergonomic design, limitations of anthropomorphic data, use of computerized database.	**8**

SELF-STUDY COMPONENT:

Module 1: Collection of anthropometric data of body parts.
Module 2: Ergonomic Chair Design.
Module 3: Design of Display for various automobile/ Industrial application.
Module 4: Use of color for engineering equipments on shop floor.
Module 5: Aesthetic expressions for Building Elevation.

NOTE:

1) Questions for CIE and SEE not to be set from self-study component.
2) Assignment Questions should be from self-study component only.

TEXT BOOKS:

1: Mayall W.H." Industrial Design for Engineers" London Hliffee Books Ltd., 1988.

REFERENCE BOOKS:

1) Introduction to Ergonomics, R C Bridger, McGraw-Hill, Publications.
2) Brien Shakel" Applied Ergonomics Hand Book" ButterWorth Scientific, London1988.
3) Human Factors in Engineering Design, Mccormick.
4) Work study, ILO, 3rdedition, 2006.

MEDICAL IMAGING TECHNIQUES

Sub Code: 18ML7IEMIT	**Credits: 03**
L: T: P: S: 3: 0: 0: 0	**CIE Marks: 50**
Exam Hours: 03	**SEE Marks: 50**
Total hours: 40	

OBJECTIVES:

1) To learn the physics of image formation in medical imaging.
2) To know how to assess image quality in different medical imaging systems using signals and systems concepts.
3) To know the instrumentation used in medical imaging.

COURSE OUTCOMES:

After completion of the course, the graduates will be able to:

CO1	Have knowledge on basic physical principles behind major medical imaging techniques
CO2	Knowledge on the image formation, image quality, and imaging hardware for different imaging modalities
CO3	Understand sub system components involved in each modality
CO4	Analyse production of signal generation in different imaging modalities
CO5	Evaluate the importance of modern medical imaging by block diagram approach to recent developments in imaging modalities
CO6	Develop a basic familiarity with all the modern medical imaging techniques employed in modern hospitals

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	-	2	-	-	-	1	-	-	-	2
CO2	3	3	2	2	-	-	-	1	1	1	1	1
CO3	3	2	2	2	-	-	-	-	1	1	-	1
CO4	3	3	2	1	-	-	-	-	1	1	-	-
CO5	3	1	3	2	-	-	-	-	1	1	-	-
CO6	3	1	2	2	-	-	-	1	1	1	-	1

COURSE CONTENTS

UNIT	Course Content	Hrs	COs

1	**X-RAY MACHINES AND DIGITAL RADIOGRAPHY**: Basics of diagnostic radiology, nature of X-Rays, production of X-Rays, X-Ray machine, visualization of X-Rays, dental X-Ray machines, Portable and mobile X-Ray units, Digital radiography, Fluoroscopy, Angiography, Mammography and Xeroradiography, Image subtraction.	07	CO1
2	**COMPUTED TOMOGRAPHY:** Computed tomography, system components, gantry geometry, system electronics, patient dose in CT scanners, Recent developments – Digital radiography, Digital subtraction angiography (DSA), 3D reconstruction, Dynamic Spatial Reconstructor (DSR). **RADIONUCLIDE IMAGING**: Radio-isotopes in medical diagnosis, physics of radioactivity, radiation detector, pulse height analyser, uptake monitoring equipment, emission computed tomography, Single – Photon Emission Computed Tomography (SPECT), Positron Computed Tomography (PET) scanner	09	CO2 CO6
3	**MAGNETIC RESONANACE IMAGING SYSTEM:** Basics of Magnetic Resonance Imaging - Fundamentals of nuclear magnetic resonance, Introduction to MRI sub systems, Imaging Methods- Introduction, slice selection, frequency encoding, phase encoding, Spin-Echo imaging- Gradient echo imaging, Blood flow imaging, Characteristics of RI ges- Spatial resolution, image contrast. Biological effects of magnetic fields- Static magnetic fields, Radio-frequency fields, Gradient magnetic fields, Imaging safety, Functional MRI.	09	CO3 CO6
4	**ULTRASONIC IMAGING SYSTEMS**: Diagnostic ultrasound, physics of ultrasonic waves, medical ultrasound, basic pulse echo apparatus, imaging modes, modern ultrasound imaging systems, portable ultrasound systems, biological effects of ultrasound, Biological effects of ultrasound	08	CO4
5	**THERMAL IMAGING SYSTEMS:** Medical thermography, physics of thermography, infrared detectors, thermographic equipment, quantitative medical thermography, pyroelectric vidicon based thermographic camera, thermal camera based on IR array sensor	07	CO5

SELF-STUDY COMPONENT:

UNIT 1: Digital radiography
UNIT 2: Recent developments in CT
UNIT 3: Functional MRI
UNIT 4: Modern hand held and low cost ultrasound systems
UNIT 5: Applications of medical thermal imaging

NOTE:

1) Questions for CIE and SEE not to be set from self-study component.
2) Assignment Questions should be from self-study component only.

TEXT BOOKS:

1) R. S. Khandpur, "Handbook of Biomedical Instrumentation", 3rdEdition, Tata McGraw Hill, 2014
2) K. Kirk Shung, Michael Smith, Benjamin M.W. Tsui, "Principles of medical imaging", Academic Press, 1st edition, 2012

REFERENCE BOOKS:

1) Jerrold T. Bushberg, John M. Boone, "The essential physics of medical imaging", Lippincott Williams & Wilkins, 3rd edition, 2011
2) Nadine Barrie Smith, Andrew Webb, "Introduction to medical imaging: Physics, Engineering and clinical applications", Cambridge University Press, 1st edition, 2010
3) M. A. Flower (Editor), "Webb's Physics of medical imaging, Second Edition", CRC Press, Taylor & Francis Group, ISBN: 978-0-7503-0573-0, 2nd edition, 2016.

WIRELESS COMMUNICATION AND FUTURE TRENDS

Sub Code: 18TE7IEWFT	**Credits: 03**
L: T: P: S: 3: 0: 0: 0	**CIE Marks: 50**
Exam Hours: 03	**SEE Marks: 50**
Total hours: 40	

OBJECTIVES:

1) To represent schematic of communication system model.
2) To understand basic wireless networks concepts, issues and standards.
3) To analyze the evolution of mobile radio communication and cellular concepts.
4) To illustrate the different wireless communication networks.
5) To describe the basic sensor networks and applications of WSN.
6) To classify satellite orbits and sub-systems for communication.

COURSE OUTCOMES:

After completion of the course, the graduates will be able to:

CO1	Describe the fundamental concepts of communication systems.
CO2	Understand the technicalities such as basic wireless network concepts, issues and standards.
CO3	Understand the Mobile Radio Communications, Cellular Concepts and Handoff Strategies.
CO4	Understand the background of Wireless Sensor Networks.
CO5	Analyze the Applications of Wireless Sensor Networks.
CO6	Comprehend the basics of satellite communication, Kepler laws and Orbits.

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3				2	2			3		1
CO2	3	3										
CO3	3	3	2									1
CO4	3	3	2			2	2					
CO5	3	3	2			1						1
CO6	3	2	2									1

COURSE CONTENTS

UNIT	Course Content	Hrs	COs

1	**Introduction to Communication Systems** Introduction, wireless communication system, wireless media, frequency spectrum, technologies in digital wireless communication, wireless communication channel specifications, types of wireless communication systems.	**08**	**CO1, CO2**
2	**Basics of Wireless Networks** Introduction, Wireless network, wireless switching technology, wireless communication problems, wireless network reference model, wireless networking issues, wireless networking standards.	**08**	**CO2**
3	**Wireless Communication** Evolution of Mobile Radio Communications, Cellular Concepts: Frequency Reuse, Channel Assignment Strategies, Handoff Strategies, Prioritizing Handoffs, Interference and System Capacity.	**08**	**CO3**
4	**Wireless Sensor Networks and Applications** Background and Application of Sensor Network, Basic Sensor Network Architectural Elements. Applications of Wireless Sensor Networks: Range of application, Examples of category I WSN applications, Examples of category II WSN applications.	**08**	**CO4, CO5**
5	**Satellite Communication** Introduction, Frequency allocation, INTELSAT, Orbits: Kepler laws, Orbital elements, Orbit perturbations, Inclined orbits, Geostationary orbit	**08**	**CO6**

SELF-STUDY COMPONENT:

Module-1	Modulation and Multiplexing techniques.
Module-2	IEEE 802. wireless networking standards.
Module-3	Design considerations and requirements of wireless networks.
Module-4	Taxonomy of Wireless sensor Network Technology.
Module-5	Local mean Solar Time and Standard Time.

NOTE:

1) Questions for CIE and SEE not to be set from self-study component.
2) Assignment Questions should be from self-study component only.

TEXT BOOKS:

1) Dr.Sunilkumar S Manvi and Dr.Mahabaleshwar S. Kakkasageri, Wireless and Mobile Networks: Concepts and Protocols, Wiley Publications, 2010.
2) Theodore S. Rappaport, Wireless Communications: Principles and Practice, Prentice Hall PTR, 2002.
3) Kazem Sohraby, Daniel Minoli, Taieb Znati, “Wireless Sensor Networks: Technology, Protocols, and Applications”, John Wiley Publication, 2007.
4) Satellite Communications, Dennis Roddy, 4th Edition, McGraw-Hill International edition, 2006.

REFERENCE BOOKS:

1) Roy Blake, “Electronic Communication Systems”, Thomson/Delamar, 2nd edition, 2002, ISB: 978-81-315-0307-2.
2) George Kennedy, “Electronic Communication Systems”, Tata McGraw Hill 3rdEdition 2008, ISBN: 0-02-800592-9.

NANO SCIENCE AND TECHNOLOGY

Sub Code: 18PH7IENST	**Credits: 03**
L: T: P: S: 3: 0: 0: 0	**CIE Marks: 50**
Exam Hours: 03	**SEE Marks: 50**
Total hours: 40	

COURSE CONTENTS

UNIT	Course Content	Hrs	COs
1	**UNIT – I Introduction to Nanoscience** Bulk vs nanomaterials, natural and synthetic nanomaterials. Size dependent physicochemical properties of nanomaterials, Size dependent properties of semiconductor and metal nanoparticles. Density of states for 0D, 1D, 2D and 3D.	**8**	**CO1**
2	**UNIT – II Thin films and synthesis of nanomaterials** Importance of vacuum techniques, Vacuum ranges, Stages of thin film growth, Block diagram of a thin film unit, Process of thermal evaporation, Bottom-up approaches for nanostructure fabrication: Sol-gel method, Top down approaches for nanostructure fabrication: Ball milling, Lithography.	**8**	**CO1** **CO2**
3	**UNIT – III Instrumentation and characterization of nanomaterials** Construction and working of Scanning Tunnelling microscopy (STM), Construction and working of Atomic Force Microscopy (AFM), Different modes of AFM operation: contact, non contact and tapping mode.	**8**	**CO1** **CO2**
4	**UNIT IV Carbon Nanotubes** Forms of Carbon, Structure of carbon nanotubes, Preparation of Carbon Nano-Tubes (CNT): Arc discharge method and Laser ablation of CNT preparation, Properties of CNT: Electrical, Thermal and Mechanical properties of CNTs, Applications: Electronic applications.	**8**	**CO1** **CO2** **CO3**
5	**UNIT V Applications of Nanostructures and Nano processes** Electronic applications: Quantum Wells, Wires and Dots, Quantum Computers. Spintronics, MEMS based gas sensors. Water conditioning and purification using nano technology.	**8**	**CO1** **CO2** **CO3**

SELF-STUDY COMPONENT:

UNIT 1: Scope of nanotechnology, Sectors influenced by nanotechnology.
UNIT 2: Atomic layer deposition, Molecular beam epitaxy (MBE), Self assembly method
UNIT 3: SEM and TEM
UNIT 4: Graphene
UNIT 5: Applications: drug delivery, Super capacitors, Batteries.

NOTE:

1) Questions for CIE and SEE not to be set from self-study component.
2) Assignment Questions should be from self-study component only.

TEXT BOOKS:

1) M. R. Srinivasan, “Applied Solid State Physics”, New Age International, India.
2) B. Viswanathan, “Nano Materials”, Narosa Publications, New Delhi, India.

REFERENCE BOOKS:

1) K.L. Chopra, Thin film Phenomena, Mc Graw Hill, New York.
2) A.K. Bandyopadhyay, Nano Materials, New Age International, India.

CHEMISTRY OF ENGINEERING MATERIALS

Sub Code: 18CM7IECEM	**Credits: 03**
L: T: P: S: 3: 0: 0: 0	**CIE Marks: 50**
Exam Hours: 03	**SEE Marks: 50**
Total hours: 40	

OBJECTIVES:

1) To provide students with knowledge of engineering materials for building technical competence in industries, research and development in the following fields.
2) To know the fundamental science and engineering principles relevant to materials.
3) To appreciate the applications of research, the value of continued learning and environmental/social issues surrounding materials.
4) To understand the relationship between nano/microstructure, characterization, properties processing and design of materials.

COURSE OUTCOMES:

After completion of the course, the graduates will be able to:

CO1	Identify the materials for design and construction.
CO2	Recognize the contemporary issues relevant to Materials Science and Engineering
CO3	Explain the basic aspects of advanced materials and their applications in the field of Engineering and Technology.
CO4	Apply the core concepts of chemistry in modern materials Engineering practice.
CO5	Analyze the data, processes, techniques and skills involved in the manufacturing of materials
CO6	Appraise the importance of modern materials in providing Engineering solutions in a global, environmental and societal context

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	---	---	---	---	---	---	---	---	---	---
CO2	3	1	---	---	---	---	---	---	---	---	---	---
CO3	3	1	---	---	---	---	---	---	---	---	---	---
CO4	3	1	---	---	---	---	---	---	---	---	---	---
CO5	3	1	---	---	---	---	---	---	---	---	---	---
CO6	3	1	--	---	---	---	--	---	---	---	---	---

COURSE CONTENTS

UNIT	Course Content	Hrs	COs

1	**UNIT I - ENGINEERING CERAMICS, COMPOSITES AND ALLOYS** **Ceramics:** Definition, classification, synthesis, properties and applications of SiC & Al_2O_3. Super hard ceramics - properties and applications of Tungsten carbide and Boron nitrides. **Composites:** Introduction, Definition, classification, Polymer-Nano clay composites and polymer-carbon nanotubes composites, Applications, Advantages and disadvantages. **Copper alloys**- Introduction, Properties and applications of Cu-Al, & Cu-Si. **Aluminium alloys -** Introduction, Properties and applications of Al-Si & Al-Li alloys.	**8**	**CO (1-6)**
2	**UNIT II – COMMODITY AND ENGINEERING POLYMERS** Liquid crystal polymers- Definition, structural properties and applications. Conductive polymers: -Definition, properties, applications, synthesis and mechanism of conduction in Polyaniline. High Performance fibers: Introduction, Kevlar- Synthesis, properties and applications. Photonic polymers: Introduction, PMMA-Synthesis, properties and applications. Elastomers: Introduction, Silicone and neoprene - Synthesis, properties and applications. Inorganic Polymers: Introduction, synthesis, properties and applications of Polyphosphazenes, Polysiloxanes and Polysilanes. 3D Printing Polymers-Structure, properties and applications of polylactic acid	**8**	**CO (1-6)**
3	**UNIT III – ELECTRONIC AND BIO-MATERIALS** **Electronic materials:** Classification of electronic materials **Semiconductors**-Introduction, Intrinsic and extrinsic semiconductors. Doping, Energy bands in semiconductors, density of states, E-K diagrams, band gap engineering, safe disposal of electronic materials. Applications of semiconductors in solar cells, photoconductors, phototransistors and light emitting diodes. **Bio-materials:** **Bio implants**- Introduction, Definition, Metallic implant materials (stainless steel, cobalt-based and titanium-based alloys) and biocompatibility. **Biosensors**- Definition, classification and applications. Construction and working of glucose biosensor	**8**	**CO (1-6)**
4	**UNIT IV- CHARACTERIZATION OF MATERIALS** **Powder X-ray diffraction techniques:** Diffraction methods, application of Powder X-ray diffraction in the determination of crystal structure of NaCl. **Electron microscopy:** Principle, applications of Scanning electron microscope (SEM), Transmission electron microscopy (TEM), Scanning Tunneling Microscopy (STM) and Atomic Force Microscopy (AFM). **Thermal analysis:** Principle, Instrumentation of Thermal gravimetric analysis (TGA) and Differential Thermal analysis (DTA)	**8**	**CO (4-6)**
5	**UNIT V- NANOMATERIALS:** Introduction, size dependent properties (surface area, electrical and optical), Synthesis (top-down and bottom up approaches): Sol-gel, chemical vapor deposition, thermolysis, hydrothermal method.	**8**	**CO (1-6)**

	Quantum dots: Definition, synthesis, advantages, limitations and applications. Graphene- synthesis (Hummer's method), properties and applications. Applications of nano materials with examples in Drug delivery, Solar cells, comparision between solar cells and quantum dot sensitized solar cells and sensors.		

SELF-STUDY COMPONENT:

Unit 1: General characteristics of ceramic materials and advantages of composite materials.
Unit 2: Differences between Organic and Inorganic Polymers.
Unit 3: Application of Semiconductors in Photovoltaic cells.
Unit 4: Interpretation of PXRD pattern of ZnO
Unit 5: Application of Nano materials in water purification.

NOTE:

1) Questions for CIE and SEE not to be set from self-study component.
2) Assignment Questions should be from self-study component only.

REFERENCE BOOKS:

1) W.D. Kingery, H.K. Bowen, and D.R. Uhlmann, "Introduction To Ceramics", John Wiley and Sons, 1976.
2) D. W. Richerson, "Modern Ceramic Engineering," Second Edition, Marcel Dekker Inc., (1992).
3) Buddy D. Ratner, Allan S. Hoffman, Frederick J. Schoen, Jack E. Lemons, Biomaterials Science: An Introduction to Materials in Medicine, 3rd edition, 2013, Academic Press
4) Donglu Shi Nanomaterials and Devices (Micro and Nano Technologies) –2018 by Published by William Andrew
5) Robert Lanza , Robert Langer, Joseph P. Vacanti, Principles of Tissue Engineering, 4th Edition, Academic Press
6) Safa O. Kasap, Principles of Electronic Materials and Devices, McGraw-Hill Education, 2017
7) Harry R. Allcock, Introduction to Materials Chemistry, Wiley 2011.

DATA SCIENCE

Sub Code: 18MA7IEDTS	**Credits: 03**
L: T: P: S: 3: 0: 0: 0	**CIE Marks: 50**
Exam Hours: 03	**SEE Marks: 50**
Total hours: 40	

OBJECTIVES:

1) Introduce Data Science for beginners
2) Educate a structured approach to convert a complicated data problem to a well-defined solution using Mathematical concepts
3) Introduce R programming with an emphasis on basic commands pertaining to LinearAlgebra and Statistics

COURSE OUTCOMES:

After completion of the course, the graduates will be able to:

CO1	Use Linear algebra to model a data and find solutions using R code
CO2	Classify data science problems into standard typology
CO3	Optimize the solution using Optimization Technique
CO4	Analyse and Correlate results to the solution approach followed.
CO5	Evaluate the solution approach.
CO6	Validate the approach of the model using Multivariate analysis

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	1	1	1	-	-	-	-	-	1
CO2	3	2	1	1	1	1	-	-	-	-	-	1
CO3	2	2	2	1	2	1	-	-	1	-	-	1
CO4	1	3	3	2	3	2	1	-	2	1	-	1
CO5	2	2	2	1	1	1	-	-	-	-	-	1
CO6	1	3	3	2	3	3	2	1	2	1	-	1

COURSE CONTENTS

UNIT	Course Content	Hrs	COs
1	**LINEAR ALGEBRA FOR DATA SCIENCE** Introduction to Data Science. Data Representation- Data matrix. Linear Relation of data. **Algebraic View of Data:** Solving Linear equations- Vectors, linearly independent and dependent vectors, Matrices, rank, null space. Solution of over determined set of equations and Pseudo inverse. Solving linear equations using R software. **Geometric View of Data:** Representation of line and plane. Projection of a vector- Orthogonal projection. Hyper planes- half space, examples. Eigen value and Eigen Vector equation. Relation between eigen vectors, column space and null space. Finding eigen values and eigen vectors using R code.	8	CO1
2	**STATISTICAL MODELLING :** Analyzing a data - Mean, variance, covariance, correlation. Sampling Distribution: Testing of hypothesis, Small sample – t test, chi square test, F test.	8	CO2
3	**OPTIMIZATION:** Constrained optimization for data science, Nonlinear optimization, unconstrained multivariate optimization. Gradient (Steepest) Descent/ learning rule. Multivariate Optimization with equality constraints, un equality constraints. Solving data analysis problem- Illustration.	8	CO3
4	**REGRESSION ANALYSIS:** Simple linear Regression- Assumptions, verification. Multivariate linear regression- Model assessment, importance of different variables, subset selection.	8	CO4

5	**CLUSTER ANALYSIS:** logistic regression, k Nearest Neighbor (k-NN) and k – means clustering	**8**	**CO5, CO6**

SELF-STUDY COMPONENT:

MODULE 1: LU- Decomposition using R code
MODULE 2: ANOVA
MODULE 3: Solve a non-linear optimization problem using MATLAB/Excel Solver/R
MODULE 4: R code for Linear Regression
MODULE5: Case Study

NOTE:

1) Questions for CIE and SEE not to be set from self-study component.
2) Assignment Questions should be from self-study component only.

TEXT BOOKS:

4) Gilbert Strang, "Linear Algebra and its Applications", 4thEdition, Thomson Learning Asia, 2007.
5) Douglas Montgomery, George C Runger, “Applied Statistics and Probability for Engineers”6th Edition, Wiley Publication.
6) Tinsley, H. and Brown, S. (2000). Handbook of Applied Multivariate Statistics and Mathematical Modeling. Academic Press.
7) Rao, S.S. (2012). “Engineering Optimization: Theory and Practice”, 3rd Edition, New Age International Publishers.

REFERENCE BOOKS:

1) David C. Lay, "Linear Algebra and its Applications", 3rd Edition, Pearson Education (Asia) Pvt. Ltd, 2005.
2) Normann Matloff, “The Art of R Programming: A Tour of Statistical Software Design”, 1st Edition, No Starch Press, Inc.
3) Richard A Johnson, Dean W Wichern, “Applied Multivariate Statistical Analysis”, Pearson Education, Prentice Hall, 2007.

UNIVERSAL HUMAN VALUES

Sub Code: 18HS7IEUHV	**Credits: 03**
L: T: P: S: 3: 0: 0: 0	**CIE Marks: 50**
Exam Hours: 03	**SEE Marks: 50**
Total hours: 40	

COURSE CONTENTS

Unit	Course Content	Hours	COs
1	Introduction to Value Education: Understanding the need, basic guidelines, content and process for Value Education, Self-exploration-its content and process; ‘Natural Acceptance’ and Experiential Validation – as the mechanism for self-exploration, Continuous Happiness and Prosperity – A look at basic human aspirations, Right understanding, Relationship and Physical Facilities – The basic requirements for fulfilment of aspirations of every human being,	08	CO1 CO2

	Understanding Happiness and Prosperity correctly – A critical appraisal of the current scenario, Method to fulfill the above human aspirations: Understanding and living in harmony at various levels. Case studies & Practice sessions.		
2	Harmony in the Human Being: Understanding human being as a co-existence of the sentient 'I' and the material 'Body', Understanding the needs of Self ('I') and 'Body' – sukh and Suvidha, Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer), Understanding the characteristics and activities of 'I' and harmony in 'I', Understanding the harmony of 'I' with the Body: Sanyam and Svasthya; correct appraisal of physical needs, meaning of prosperity in detail, Programs to ensure Sanyam and Svasthya, Case studies & Practice sessions.	08	CO1 CO2
3	Harmony in the Family and society: Understanding harmony in the Family – the basic unit of human interaction, Understanding values in human-human relationship; meaning of Nyaya and program for its fulfilment to ensure Ubhaya –tripti; Trust (Visvasa) and Respect (Sammana as the foundational values of relationship, Understanding the meaning of Visvasa; Difference between intention and competence, Understanding the meaning of Sammana, Difference between respect and differentiation; the other salient values in relationship, Understanding the harmony in the society (society being an extension of family): Samadhana, Samriddhi, Abhaya, Sah-astitva as comprehensive Human Goals, Visualizing a universal harmonious order in society-Undivided Society (Akhand Samaj), Universal Order (SarvabhaumaVyavastha)-from family to world family, Case studies & Practice sessions.	08	CO3 CO4
4	Harmony in the Nature (Existence): Understanding the harmony in the Nature, Interconnectedness and mutual fulfilment among the four orders of nature – recyclability and self-regulation in nature, Understanding existence as co-existence (Sah-astitva) of mutually interacting units in all-pervasive space, Holistic perception of harmony at all levels of existence., Case studies & Practice sessions.	08	CO3 CO4
5	Implications of the Holistic Understanding – A Look at Professional Ethics: Natural acceptance of human values, Definitiveness of Ethical Human Conduct, Basis for Humanistic Education, Humanistic Constitution and Universal Human Order, Competence in Professional Ethics: Ability to utilize the professional competence for augmenting universal human order, Ability to identify the scope and characteristics of people-friendly and eco=friendly production systems, technologies and management models, At the level of individual: as socially and ecologically responsible engineers, technologists and managers, At the level of society: as mutually enriching institutions and organizations, Case studies & Practice sessions.	08	CO5 CO6

SELF-STUDY COMPONENT:

Case studies on typical holistic technologies, management models and production systems; Strategy for transition from the present state to Universal Human Order.

NOTE:

1) Questions for CIE and SEE not to be set from self-study component.
2) Assignment Questions should be from self-study component only.

TEXT BOOKS:

1) A foundation course in HUMAN VALUES and Professional ethics; presenting a universal approach to value education- through self exploration by, R R Gaur, R Sangal & GP Bagaria, Excel books Pvt. Ltd.
2) Professional Ethics & Human Values: Prof. D.R. Kiran, TATA Mc Graw Hill Education

REFERENCE BOOKS:

1) Human Values: A. N. Tripathy (2003, New Age International Publishers)
2) Ethics in Engineering Mike W. Martin, Department of Philosophy, Chapman University and Roland Schinzinger, School of Engineering, University of California, Irvine.
3) Fundamentals of Ethics, Edmond G. Seebauer & Robert L. Barry, Oxford University Press.