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Open Elective Courses-AR 19

Open Elective Courses I-IV Syllabus

GMR Institute of Technology
Rajam 532 127, Andhra Pradesh
Accredited by NAAC & NBA

19CE001 Disaster Management

3 1 0 3

Course outcomes

1. Build knowledge about need and importance of hazard management in the concern field
2. Understand the causes of Natural and Manmade disasters
3. Outline the mitigation measures for Natural and Manmade disasters
4. Understand the importance of science and technology in disaster risk management
5. Build knowledge on importance of authorities and their risk management
6. Understand the scenarios of various disasters and mitigation

COs–POs Mapping

COs	PO2	PO7
1	2	2
2	3	3
3	3	2
4	3	3
5	1	2
6	1	3

3–Strongly linked | 2–Moderately linked | 1–Weakly linked

Unit I

Introduction to Disaster Management

Components of disaster management-Organizational structure for disaster management–Disaster Risk Reduction –Global Policies and Practices - Basic Strategies and Practices of Disaster Reduction- Disaster Risk Reduction with Global Framework - Integrated disaster management.

Role of Government and NGO Bodies, Role of Engineers on Disaster Management.

12+3 Hours

Unit II

Natural and Manmade Disasters

Management of Natural Disasters: Floods, Droughts, Earthquakes, Global Warming, Cyclones, Landslides, Tsunamis Causes, effects, mitigation. Effects on poverty, Climate Change and Human Health.

Management of Manmade Disasters: Solid waste, Fire, Bio-terrorism, Emerges infectious diseases, Transportation Accidents, Structural failures Causes, effects, mitigation.

Volcanic eruptions, mining.

11+4 Hours

Unit III

Science and Technology in Disaster Management

Implementation of Technology for Infrastructure, Disaster Management for Infrastructure, Geospatial Information in Agriculture Drought Assessment and Monitoring. Multimedia Technology in Disaster Risk Management Training, Disaster Communication System (Early Warning and its Dissemination) - Essentials of School Disaster Education, Community based Disaster Management.

Role of IT in Disaster Preparedness, Role of Educational Institute

11+4Hours

Unit IV

Disaster Risk Management in India and Case Studies

Disaster Management Indian scenario - India's vulnerability profile – Roles and responsibilities of government, community, local institutions, NGOs and other stakeholders, Policies and legislation for disaster risk reduction, DRR programs in India and the activities of National Disaster Management Authority.

Cases Studies: Natural Disaster -Floods, Earthquakes, Cyclones, Tsunamis. Manmade Disaster: Industrial Accidents, Transportation Accidents and Terrorism & Bio-terrorism.

Droughts, *Nuclear Disaster.*

11+4Hours

Total: 45+15Hours

Text Book(s):

1. Disaster management - Global Challenges and local solution, Edited by Rajibshash and R.R.Krishnamurthy (2009) published by universities press
2. Disaster management - future challenges and opportunities (2007) editor by Jagbirsingh. Published by I K international Publishing house pvt.Ltd.
3. Disaster management, (2021), editor by R. Subramanian, Vikas Publishing, Noida.

Reference Book(s):

1. Disaster management edited by H K Gupta (2013) published by universities press.

Sample Question (S)

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Open Book Exam (%)
Remember	40	40	-
Understand	60	60	100
Apply	-	-	-
Analyze	-	-	-
Evaluate	-	-	-
Create	-	-	-
Total (%)	100	100	100

Remember

1. What are the different phases of disaster management cycle?
2. "Prevention is better than cure is opted proverb in the context of disaster management" Explain.
3. How do you frame a system to overcome the risk occurred by a new hazard. **(For Open Book Examination and not for semester end examination)**

Understand

1. Explain the causes of global warming.
2. Explain the difference between environmental and social vulnerabilities.
3. How do you give frame a system for a three kinds of natural disasters? **(For Open Book Examination and not for semester end examination)**

19EE001 Electrical Installation, Safety and Auditing

3 1 0 3

Course Outcomes

1. Summarize the concepts of estimation and costing
2. Select a suitable wiring system for domestic and industrial applications
3. Identify the safety standards in residential, commercial and agricultural applications
4. Explain the energy demand and supply, energy crisis and future energy scenario
5. Illustrate Energy management techniques and perform energy audit
6. Explain various energy management measuring devices and tools

COs – POs Mapping

COs	PO_2	PO_3	PO_6	PO_8
1	2	2	2	2
2	3	3	3	3
3	3	3	3	3
4	2	2	2	2
5	2	2	2	2
6	2	2	2	2

3–Strongly linked | 2–Moderately linked | 1–Weakly linked

Unit I

Principles of estimation and design of domestic & industrial wiring

Purpose of estimating and costing, Elements of estimating & costing, Tender Document, Purchase systems, Overhead charges, Labour charges, contingencies. Types of wires, types of wiring systems, selection of wire, wiring accessories and protective devices.

IE rules for Domestic & Industrial wiring, estimate for single store yard, Estimate for a small workshop.

Estimation of power wiring systems.

11+4 Hours

UNIT-II

Safety in residential, commercial, agricultural, installation of plant & Protective tools equipment

Electricity, its Usefulness and Hazards, statutory Provisions, Indian Standards, Effects of Electrical parameters on human body, Safety measures for electric shock, overhead and other protections, portable electrical apparatus, Electric work in hazardous atmosphere, Energy conservation and safety

Precautions and safety measures in substation

11+4 Hours

UNIT-III

Characteristics of Energy audit & Management

Elements of energy audits, energy use profiles, measurements in energy audits, presentation of energy audit results, case study, Electrical system optimization

Demand side management (DSM)-techniques of DSM, peak clipping, peak shifting, valley filling, types of tariffs.

Energy efficient equipment.

12+3 Hours

Unit IV

Introduction to Energy Audit

Introduction Energy situation – world and India, energy consumption, conservation-need in thermal utility, Codes, standards and Legislation, Energy economic analysis-the time value of money concept, developing cash flow models, payback analysis, depreciation, taxes and tax credit.

Energy Policy based on management

11+4 Hours

Total: 45+15=60 Hours

Text Book(s):

1. J .B Gupta, "A Course in Electrical Installation, Estimating and Costing", S.K Kataria & Sons, 2nd Edition, 2013.
2. Albert Thumann, "Fundamentals of Energy Engineering", Prentice Hall Inc, Englewood Cliffs, New Jersey, 3rd Edition, 2013.

3. Dr. K U Mistry, "Fundamentals of Industrial Safety and Health" ,Siddharth Prakashan, 1st Edition, 2008

Reference Book(s):

1. Surjeet Singh, "Estimating and Costing", Dhanpat Rai & Co., 2nd Edition, 2003.
2. D.P.Sen, K.R.Padiyar, Indrane Sen and M.A.Pai, "Recent Advances in Control and Management of Energy Systems", Interline Publisher, 1st Edition, 2013
3. Rao, S. and Saluja, H.L., "Electrical Safety, Fire Safety Engineering and Safety Management, Khanna Publishers, 1988.
4. Albert Thumann and Willium. J. Younger, "Handbook of Energy Audits, River Publishers, 9th Edition, 2012.

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Open Book Examination (%)
Remember	25	25	---
Understand	25	50	---
Apply	50	25	100
Analyze	---	---	---
Evaluate	---	---	---
Create	---	---	---
Total (%)	100	100	100

Sample Question (s)

Remember

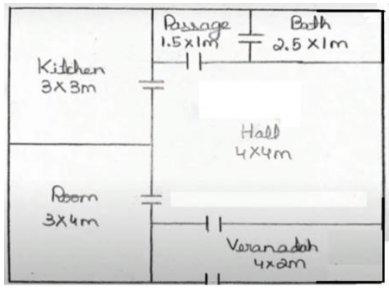
1. Define estimation and state its purpose.
2. Define power wiring.
3. Define principle of energy audit
4. Define energy management and auditing
5. Name the factors on which the fusing current depends.

Understand

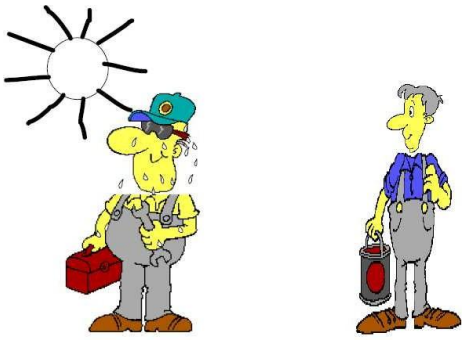
1. Interpret the size of conduit for different ratings of motors
2. Classify various types of domestic wiring and suggest their suitability for respective installation.
3. Explain the types of energy audit
4. Explain about depreciation with all methods
5. Summarize the duties of energy auditor and manager
6. Illustrate Load management
7. Formulate energy auditing report in tabular form

Apply

1. Draw the electrical circuit and develop the quantity of materials required for conduit wiring used in a house, the plan of which is shown in Figure 1. Assume the height of the ceiling is 3.6m and one plug point is to be provided in each room.



2. Develop a neat diagram showing the position of switch boards, distribution boards and accessories for a hall 0f 15m*5m*4.5m height. The hall is to be fitted with fand and light points. Make your own assumptions for the number of light and fan points and other missing data.
3. (i)Why might Worker A be injured more than Worker B if they were both shocked by the same amount of electrical current?



A B

(ii) How do electrical fires start and how can they be prevented?
(iii) How does electrical shock occur and how can it be prevented?
(iv) What are electrical safety risks in a lab?
(For Open Book Examination and not for semester end examination)

19ME001 Fundamentals of Optimization Techniques

3 1 0 3

Course Outcome(s)

1. Explain the need of optimization of engineering systems.
2. Apply classical optimization techniques, linear programming, transportation problem.
3. Explain the fundamental knowledge of dynamic programming problems.
4. Use classical optimization techniques and numerical methods of optimization.
5. Solve the problems of project management using CPM and PERT.
6. Solve Non-linear programming problems of some kinds.

CO-PO Mapping

COs	PO_1	PO_2
1	3	2
2	3	2
3	2	2
4	2	2
5	2	2
6	2	2

3 – Strongly linked | 2 – Moderately linked | 1 – Weakly linked

Unit- I

Introduction and Classical optimization Techniques:

Statement of an Optimization problem – design vector – design constraints – constraint surface – objective function – objective function surfaces – classification of Optimization problems. Classical Optimization Techniques: Single variable Optimization – multi variable Optimization without constraints – necessary and sufficient conditions for minimum/maximum – multivariable Optimization with equality constraints. Solution by method of Lagrange multipliers – Multivariable Optimization with inequality constraints – Kuhn – Tucker conditions.

11+4 hours

Unit- II

Linear Programming Problem: Standard form of a linear programming problem – geometry of linear programming problems – definitions and theorems – solution of a system of linear simultaneous equations – pivotal reduction of a general system of equations – motivation to the simplex method – simplex algorithm.

Transportation Problem: Finding initial basic feasible solution by north – west corner rule, least cost method and Vogel's approximation method – testing for optimality of balanced transportation problems.

11+4 hours

Unit- III

Dynamic Programming (D.P): Multistage decision processes. Concepts of sub optimization, Recursive Relation-calculus method, tabular method, LP as a case of D.P.

Classical Optimization Techniques: Single variable optimization without constraints, Multi variable optimization without constraints, multivariable optimization with constraints – method of Lagrange multipliers, Kuhn-Tucker conditions.

Numerical Methods For Optimization: Nelder Mead's Simplex search method, Gradient of a function, Steepest descent method, Newton's method.

11+4 hours

Unit- IV

CPM and PERT: Drawing of networks, Removal of redundancy, Network computations, Free slack, Total slack, Crashing, Resource allocation.

Non-Linear Programming: Characteristics, Concepts of convexity, maxima and minima of functions of n-variables using Lagrange multipliers and Kuhn-Tuker conditions, One dimensional search methods, Fibonacci, golden section method and gradient methods for unconstrained problems.

12+3 hours

Total: 45+15 hours

Textbook(s)

1. Operations Research: An Introduction, Prentice Hall of India (2007) 8th ed.
2. Kasana, H.S., Introductory Operation Research: Theory and Applications, Springer Verlag (2005).

3. Rardin, Ronald L., Optimization in Operations research, Pearson Education (2005). Ravindran A, Phllips D.T. and Solberg J.J.
4. Operation Research: Principles and Practice, John Wiley (2007).
5. Engineering Optimization Theory and Practice, S.S.Rao, New Age International (P) Ltd, Publishers
6. Kalyanmoy Deb Multi-objective optimization using evolutionary algorithms John Wiley Publications
7. Jasbir S. Arora Introduction to Optimum Design McGraw Hill Publication
8. Optimization for Engineering Design by Kalyanmoy Deb, PHI Publishers
9. Genetic algorithms in Search, Optimization, and Machine learning – D.E.Goldberg, Addison-Wesley Publishers
10. Operations Research by Hillar and Liberman, TMH Publishers

Sample Question(s)

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Open Book Examination(%)
Remember	10	10	-
Understand	10	10	20
Apply	80	80	80
Analyze	-	-	-
Evaluate	**-**	**-**	-
Create	**-**	**-**	**-**
Total (%)	**100**	**100**	**100**

Remember

1. What are the types of classical optimization techniques?
2. What are the draw backs of classical optimization techniques?
3. State the assumptions of cpm and pert.
4. Discuss simplex algoritham of LPP.

Understand

1. What are the limitations of PERT and CPM?
2. How non-linear programming problems are different from linear programming problems ?
3. What kind of problems can be solved through dynamic programming technique?

Apply

1. By using simplex method, inimize $Z = 2X_1+9X_2+ X_3$ Subjected to the constraints: $X_1+4X_2 +2X_3 \geq 5$, $3X_1+X_2 +2X_3 \geq 48$, $X_1 \geq 0$, $X_2 \geq 0$, $X_3 \geq 0$.
2. Find the optimal solution to the following transportation problem for which the cost, origin-availabilities and destination-requirements are as given below

	A	**B**	**C**	**D**	
I	1	2	-2	3	**70**
II	2	4	0	1	**38**
III	1	2	-2	5	**32**
	40	**28**	**30**	**32**	

3. A college student has 7 days remaining before final examinations begin in her four courses, and she wants to allocate this study time as effectively as possible. She needs at least 1 day on each course, and she likes to concentrate on just one course each day, so she wants to allocate 1, 2, 3, or 4 days to each course. Having recently taken an OR course, she decides to use dynamic programming to make these allocations to maximize the total grade points to be obtained from the four courses. She estimates that the alternative allocations for each course would yield the number of grade points shown in the following table:

	Estimated Grade Points			
	Course			
Study Days	**1**	**2**	**3**	**4**
1	3	5	2	6
2	5	5	4	7
3	6	6	7	9
4	7	9	8	9

Solve this problem by dynamic programming.

19EC001 Sensors for Engineering Applications

3 1 0 3

Course Outcomes

1. Summarize sensor characteristics and applications
2. Explain acceleration, shock and vibration sensors
3. Demonstrate position and weight sensors
4. Illustrate sound, ultrasound and infrared sensors
5. Explain the working principle of bio sensors
6. Assess the applications of chemical sensors

COs–POs Mapping

COs	PO_1
1	2
2	3
3	3
4	3
5	3
6	2

3–Strongly linked | 2–Moderately linked| 1–Weakly linked

Unit I

Sensor Fundamentals and applications

Sensor Characteristics, System Characteristics, Instrument Selection, Data Acquisition and Readout, Installation, Acceleration, Shock and Vibration Sensors: Technology Fundamentals, Selecting and Specifying Accelerometers, Applicable Standards, Interfacing and Designs

Sensor limitations, measurement issues and criteria

12+4 Hours

Unit II

Position and weight sensors

Position, direction, distance measurement-large scale, distance travelled, and rotation. Force, Load and Weight Sensors : Quartz Sensors-Charge Mode High-Impedance Piezoelectric Force Sensor, Voltage Mode Low-Impedance Piezoelectric Force Sensor, Piezoelectric Force Sensor Construction, types of Strain Gage Sensors

Special applications of strain gage sensors, gravitational sensing

13+3 Hours

Unit III

Sound, Ultrasound and Infrasound sensors

Principles, Audio to electrical sensors and transducers: moving iron microphone, moving coil microphone, capacitor microphones. Microphone problems, frequency and wavelengths. Electrical to audio transducers: moving iron transducer, moving coil transducer, Capacitor transducers. Ultrasonic transducers, Infrasound sensors.

Building acoustics, Microphone Standards

11+4 Hours

Unit IV

Biosensors and Chemical Sensors

Introduction to Biosensors, Applications of Biosensors, Origin of Biosensors, Bioreceptor Molecules, Transduction Mechanisms in Biosensors, Application Range of Biosensors, Technology Fundamentals of chemical sensors, chemical sensing techniques and applications.

Evolution of Biosensors, smoke sensors

9+4 Hours

Total: 45+15 Hours

Textbook (s)

1. Jon Wilson ,Sensor Technology Hand Book, Newnes 2004.
2. Ian.R.Sinclair,Sensors and Transducers, third edition, Newnes publications
3. Patranabis D. ,Principles of Industrial Instrumentation,TMH. 2nd edition

Reference (s)

1. Patranabis D, Sensors and Transducers, 2nd Edition, PHI, New Delhi, 2010
2. E. O. Doeblin ,Measurement system: Applications and Design, fourth edition,McGraw Hill

Publications.

SAMPLE QUESTION (S)

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Open Book Exam (%)
Remember	20	20	--
Understand	50	40	60
Apply	30	40	40
Analyze	-		
Evaluate	--	--	--
Create	--	--	--
Total (%)	100	100	100

Remember

1. Define sensors
2. List types of microphones
3. Define bioreceptor molecules.
4. List types of strain gages

Understand

1. Represent acceleration sensors
2. Illustrate Charge Mode High-Impedance Piezoelectric Force Sensor.
3. Identify Transduction Mechanisms in Biosensors.

Apply

1. Demonstrate electrical to audio transducers.
2. Demonstrate Transduction Mechanisms in Biosensors.
3. Demonstrate gas chromatograph.
4. Find a suitable sensor for the treatment of insulin-dependent diabetes with open loop approach that is portable and requires minimal operational skill. **(For Open Book Examination and not for semester end examination)**.
5. Water's conductivity varies by several orders of magnitude as it varies from ultrapure to ordinary tap water. Carry-out the use of a simple inexpensive sensor to measure water impurities. **(For Open Book Examination and not for semester end examination)**

19CS001 Fundamentals of Artificial Intelligence

3 1 0 3

Course Outcomes

1. Summarize the fundamental concepts of Artificial Intelligence.
2. Illustrate the Concepts of Heuristic Search Techniques.
3. Demonstrate working knowledge of reasoning in the presence of incomplete and/or uncertain information
4. Make use of concept of Game Playing Algorithms.
5. Outline the concept of Planning System
6. Explain the Natural language processing system

CO–PO Mapping

CO	PO1	PO2	PO3
1	2	1	2
2	2	2	3
3	3	1	1
4	1	2	2
5	1	3	2
6	1	2	2

3–Strongly linked | 2–Moderately linked | 1–Weakly linked

Unit I

Introduction

Definition, AI problems, AI techniques, Defining problem as a state space search, Production Systems-Control Strategies, Problem characteristics, Production system characteristics. Problems – tic-tac-toe, 8-puzzle problem, Chess problem, Water Jug Problem, Missionaries and cannibals' problem, Monkey and banana problem.

Application of AI-Tower of Hanoi problem- *Travelling Salesman Problem*

12+3 Hours

Unit II

Heuristic Search Techniques

Generate-and-test, Hill climbing, Best-first-search – OR Graphs – A* Algorithm, Problem reduction – AND-OR Graphs – AO* Algorithm, constraint satisfaction - cryptarithmetic problem.

Depth-first search – Breadth-first search- Data abstraction

11+4 Hours

Unit III

Knowledge representation

Knowledge Representation Issues, Representation and mapping, Approaches to Knowledge Representation, Frame Problem, Propositional logic, Predicate logic, Resolution, weak slot and filler structure-semantic nets.

Filler structures-conceptual dependency-scripts

11+4 Hours

Unit IV

Game Playing and Planning

Mini-max search, Alpha-beta cutoffs, planning system, Block world problem, goal stack planning, hierarchical planning, Natural language processing, syntactic processing. Decision trees, Perception, Vision, Speech recognition.

Learning - Navigation – Manipulation - Robot Architecture

11+4 Hours

Total: 45+15 Hours

Textbook (s)

1. E. Rich K .Knight, and B. Nair, Artificial Intelligence, 3rdEdition, TMH, 1 July 2017
2. Russel Norvig, Artificial Intelligence A modern Approach, 3rd Edition, Pearson Education, 2010

Reference (s)

1. Patrick henry Winston, Artificial Intelligence, third edition, Pearson Education Asia, 2005
2. Dan W. Patterson, Introduction to Artificial intelligence and Expert Systems, 2nd Edition, PHI, 2009

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Open Book Exam (%)
Remember	40	40	--
Understand	30	40	--
Apply	30	20	70
Analyze	--	--	30
Evaluate	--	--	--
Create	--	--	--
Total (%)	100	100	100

SAMPLE QUESTION (S)

Remember

1. State the tasks, which are associated with A.I.
2. Give an example of crypt-arithmetic problem.
3. Define Speech Recognition.
4. Recall Intelligence

Understand

1. Explain Turing Test.
2. Explain the characteristics of production system.
3. Write A* algorithm in detail and explain its functionality to solve 8-puzzle problem.
4. Explain the semantic analysis phase done through case grammars in Natural Language understanding

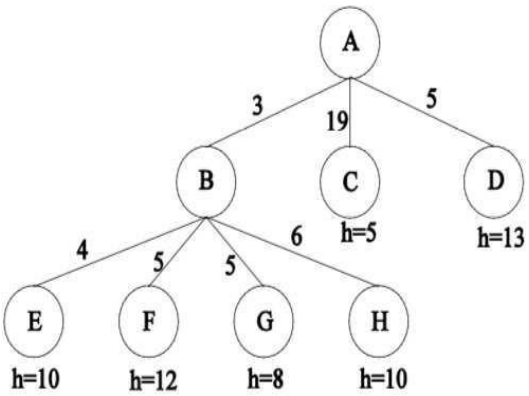
Apply

1. Distinguish between weak and strong slot filler structures
2. Discuss the tic-tac-toe problem in detail and explain how it can be solved using AI technique
3. Construct semantic net representation for the following:
   (i) Pompeian (Marcus), Blacksmith (Marcus)
   (ii) Mary gave the green flowered vase to her favorite cousin.

Open Book Exam Questions

Question 1:

Consider the following search tree produced after expanding node A, where each arc is labeled and the leaves are labeled with the value of a heuristic function, h.



(i) Identify the node, which is expanded next by each of the following search methods?

(a) Breadth First Search

(b) Depth-First Search

(c) Best-First Search

(d) A* Search

(e) AO* Search

(ii) Construct the Min Max Tree for the above figure (ignoring the cost values)

(iii) Identify whether the tree is eligible for pruning or not, if it is yes trace the alpha beta prunes

19CH001 Energy Conversion and Storage Devices

3 1 0 3

Course Outcomes

1. Outline the need of energy storage systems
2. Identify new technologies for energy storage and conversion systems
3. Select and defend appropriate fuel cell technology for a given application
4. Summarize the different types of fuel cells and batteries
5. Explain the performance of specific battery and fuel cell systems
6. Enumerate suitable hydrogen storage system to be used along with fuel cell system

COs – POs Mapping

COs	PO_1	PO_3	PO_6	PO_7
1	3	--	2	3
2	3	3	2	3
3	2	1	2	3
4	2	3	2	3
5	3	1	2	3
6	3	1	2	3

3–Strongly linked | 2–Moderately linked | 1–Weakly linked

Unit I

Introduction to Energy Conversion and Storage Systems

Classification of Energy Sources, Principle fuels for energy conversion, Necessity of energy storage, different types of energy storage, mechanical, chemical, electrical, electrochemical, biological, magnetic, electromagnetic, thermal, comparison of energy storage technologies

Fuel cells- Batteries- Super capacitors

12+3 Hours

Unit II

Energy Conversion Systems

Fuel cells: Introduction and overview, operating principle, polarization curves, components, types of fuel cell, low and high temperature fuel cells, fuel cell stacks. Fuel cell characterization and analysis of polarization curve and calculate kinetic, ohmic, and transport losses; estimate internal resistance and hydrogen cross-over of the fuel cell

Faraday's law, Open circuit voltage, ohomic resistance, limiting current

11+4 Hours

Unit III

Energy Storage Devices

Fundamentals and technologies, characteristics and performance comparison: Lead-acid, Nickel-Metal hydride, Lithium Ion; Battery system model, emerging trends in batteries.

Hybrid systems for energy storage

12+4 Hours

Unit IV

Design and Applications of Energy Storage

Renewable energy storage-Battery sizing and stand-alone applications, stationary (Power Grid application), Small scale application-Portable storage systems and medical devices, Mobile storage Applications- Electric vehicles (EVs), types of EVs, batteries and fuel cells, future technologies, hybrid systems for energy storage

Nernst equation- Butler–Volmer theory- Gibbs free energy

11+3 Hours

Total: 45+15 Hours

Textbook(s)

1. O' Hayre R. P., Cha S. W., Colella W., and Prinz F. B., Fuel cell fundamentals, John Wiley, 2008
2. Larminie J., Dicks A. and McDonald M. S., Fuel cell systems explained. Vol. 2, Wiley, 2003
3. Bailie, Richard C, Energy conversion engineering, Wesley, 1978

Reference (s)

1. Vielstich W., Lamm A., and Gasteiger H. A, Handbook of Fuel Cells: Fundamentals, Technology, Applications, Vol (1-4), Wiley, 2003
2. Gupta R. B, Hydrogen Fuel: Production, Transport and Storage, CRC Press, 2008
3. Bard A. J., Faulkner L. R., Leddy J., and Zoski, C. G, Electrochemical methods: fundamentals and applications (Vol. 2), Wiley, 1980

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Assignment test (%)
Remember	20	20	--
Understand	30	30	40
Apply	50	50	60
Analyze	--	--	--
Evaluate	--	--	--
Create	--	--	--
Total (%)	100	100	100

Sample Question (s)

Remember

1. List any two types of fuel cells and their uses.
2. What is open circuit voltage?
3. Define limiting current.
4. Define glass transition temperature.

Understand

1. Distinguish high temperature fuel cells and low temperature fuel cells.
2. Explain in detail the principle and mechanism of lithium ion battery.
3. Explain about fuel cell characterization.
4. Discuss about portable energy storage systems.

Apply

1. A company is developing a new car powered by a fuel cell system that runs on H2. You have been asked to consider generating the H2 by electrolysis with a fuel cell. The H2 tank to be used is 10 liters in volume and a fill-up requires a pressure of 34 atm.
2. Consider the following specifications of the system. 60% conversion of H2O Eo = 1.172 V The cathode pressure is maintained at 1 atm. The anode pressure is maintained at 1 atm Membrane thickness = 100 μm Membrane conductivity (σ) = 0.1 S/cm (S = 1/Ω) Electrolysis T = 373 K (assume water is in the gas phase) H2 storage tank T = 298 K
   a) Calculate the current required to operate at a voltage of 1.8V.
   b) Calculate the rate of hydrogen production per membrane area and the total membrane area required to fill the tank in 2 minutes.
   c) How the fuel cell car is more viable than a diesel or petrol car. Justify?
3. The polarization curve for the fuel cell consists of 3 different losses such as ohmic, activation and mass transport in these 3 losses what is predominant loss. Explain various precautions/ designs can overcome these losses.
4. Describe the selection criterion for choosing the specific fuel cell among the alternatives present in the market, for household application what fuel cell you suggest? Justify your answer.

19IT001 Fundamentals of Multimedia

3 1 0 3

Course Outcomes

At the end of the course, students will be able to

1. Understand key concepts in multimedia technology.
2. Identify basic multimedia types and data representations.
3. Describe transmission of audio and video.
4. Explain multimedia data compression techniques.
5. Identify various video and audio compression techniques.
6. Demonstrate technical knowledge and limited proficiency in designing production elements.

COs – POsMapping

COs	PO_1	PO_5	PO_7
1	3	3	2
2	3	3	1
3	3	3	2
4	2	3	2
5	3	3	1
6	2	3	3

3–Strongly linked | 2–Moderately linked | 1–Weakly linked

Syllabus

Unit I

Introduction to multimedia

What is multimedia?, Multimedia and Hypermedia, World Wide Web, Overview of Multimedia Software Tools, Graphics and Image Data Representations: Graphics/Image Data Types, Color in Image and Video: Color Science, Color Models in Images, Color Models in Video.

Popular file formats.

13+3 Hours

Unit II

Fundamental Concepts in Video and Digital Audio

Types of Video Signals, Analog Video, Digital Video, Digitization of Sound, MIDI, Quantization and Transmission of Audio.

DPCM, DM, ADPCM

10+5 Hours

Unit III

Multimedia Data Compression

Lossless compression algorithms: Run-Length Coding, Variable Length Coding, and Dictionary Based Coding. Lossy compression algorithms: Quantization, Transform Coding, Wavelet-Based Coding

Arithmetic Coding, Lossless Image Compression

12+4 Hours

Unit IV

Basics of Video and Audio Compression

Introduction to Video Compression, Video Compression based on Motion Compensation, Search for Motion Vectors, Video Coding Overview of MPEG-1, MPEG-2,MPEG-4

ADPCM in Speech Coding, MPEG Audio Compression.

MPEG-7, Basics of Computer and Multimedia networks

10+3 Hours

Total: 60 Hours

Textbook (s)

1. Ze-Nian Li and Mark S.Drew, "Fundamentals of Multimedia", 1st Edition, PHI/Pearson Education, 2009.
2. Weixel, "Multimedia Basics", 2nd Edition, Thomson Press, 2006.

Reference (s)

1. Nigel Chapman and Jenny Chapman, "Digital Multimedia", 3rd Edition, Wiley Dreamtech, 2009.

2. Steve Heath, "Multimedia and Communications Technology", 2nd Edition, Elsevier (Focal Press), 1999.
3. Steinmetz, Ralf, Nahrstedt, "Multimedia Applications", 1st Edition, Springer, 2004.

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Open Book Exam (%)
Remember	40	40	--
Understand	60	60	60
Apply			40
Analyze			--
Evaluate	--	--	--
Create	--	--	--
Total (%)	100	100	100

Sample Question (S)

Remember

1. Define multimedia
2. List some multimedia software.
3. List some multimedia hardware

Understand

1. Explain the application of multimedia in education and e-commerce
2. Explain analog and digital video in details
3. Explain the need of multimedia and write down is applications
4. Illustrate the scope of multimedia in e-governance

Apply

1. Implement Huffman coding, adaptive Huffman coding, arithmetic coding and LZW coding algorithms using your favorite programming language. Generate at least three types of statistically different artificial data sources to test your implementation of these algorithms. Compare and comment on each algorithm's performance in terms of compression ratio for each type of data source. **(For Open Book Examination and not for semester end examination).**
2. Assume we have an unbounded source we wish to quantize using an M-bit mid tread uniform quantizer. Derive an expression for the total distortion if the step size. **(For Open Book Examination and not for semester end examination).**

19BS001 Nano Materials and Technology

3 1 0 3

Course Outcomes

1. Apply various chemical and physical methods for the synthesis of nanomaterials
2. Explain the properties of nano-materials and their applications in relation to bulk materials
3. Describe the nano size effect on optical, electrical, magnetic and thermal properties
4. Characterize nano materials by powder XRD and microscopy techniques.
5. Illustrate the structure, properties and applications of Fullerenes and Carbon nanotubes.
6. Review the applications of nanomaterials, specially semiconducting metal oxides for sensing and catalysis.

COs – POs Mapping

COs	PO_1	PO_{12}
1	3	1
2	3	1
3	3	1
4	3	1
5	3	1
6	3	1

3–Strongly linked | 2–Moderately linked | 1–Weakly linked

Unit I

Introduction to Nanomaterials

Introduction to nanomaterials and nanotechnology, Nano-sizes and their unique properties: comparison with the bulk materials, Different shapes, sizes and morphology of nanomaterials; Defects in nanocrystalline materials, Effect of grain size on physical properties – magnetic, electrical, optical, thermal and mechanical properties.

Graphite to graphene – effect on properties

11+3 Hours

Unit II

Synthesis Techniques of Nanomaterials

Top Down Approaches: Grinding, Planetory milling and comparison of particles; Bottom Up Approach: Wet Chemical Synthesis - Microemulsion Approach, Colloidal Nanoparticles Production, Co-precipitation, Sol Gel Method, Hydrothermal method, Sonochemical Approach,; Gas phase Production Methods - Chemical Vapour Deposition; Carbon Nano structures: carbon clusters, carbon nano tubes, graphene-synthesis, formation.

Microwave synthesis and Atomization

12+4 Hours

Unit III

Characterization of Nanomaterials

Fractionation principles of particle size measurements, Particle size and its distribution, Distinguishing the nano size from bulk by powder X-ray Diffraction patterns; Optical transitions in solids, photonic crystals, Microscopy techniques: Scanning Electron Microscopy, EDAX, Atomic Forced Microscopy, Scanning Tunneling Microscopy, Transmission Electron Microscopy

Zeta potential, density of states

11+4 Hours

Unit IV

Applications of Nanomaterials

Self-assembly and molecular manufacturing; Surfactant based system & Colloidal system – Applications; Functional materials - Nano coatings, GaN wires, quantum dots, nano crystalline TiO_2 and ZnO; Applications of single & multi walled CNTs

Nanosensors - based on optical properties

11+4 Hours

Total: 45+15 Hours

Textbook (s)

1. B. S. Murthy, P. Shankar, Baldev Raj, B.B. Rath, Ames Murday, Text book of Nanoscience and Nanotechnology, Springer & Universities Press (India) Pvt. Ltd., 2013.
2. S. K. Kulkarni, Nanotechnology: Principles & Practices, 3rd Ed., Springer, 2015

Reference (s)

1. S. M. Lindsay, Introduction to Nanoscience, Oxford University Press, 2009
2. R. Kelsall, I. Hamley, M. Geoghegan, Nanoscale Science and Technology, John Wiley & Sons, 2005
3. G. L. Hornyak, H.F. Tibbals, J. Dutta , J. J. Moore, Introduction to Nanoscience and Nanotechnology CRC Press, 2008
4. J. H. Davies, The Physics of Low Dimensional Semiconductors: An Introduction, Cambridge University Press, 1998

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Open Book Exam (%)
Remember	20	20	-
Understand	60	60	-
Apply	20	20	100
Analyze	-	-	-
Evaluate	--	-	-
Create	--	-	-
Total (%)	100	100	100

Sample question (s)

Remember

1. Define nano structured material
2. List any four applications of nanotechnology
3. State Moore's first law and second law.

Understand

1. What is the difference between nano science and nanotechnology?
2. Describe elastic scattering and inelastic scattering of electrons
3. Explain the sol-gel method of synthesis of nano powders

Apply

1. Explain the principle behind protection of skin from UV radiation by sunscreen lotion
2. Show that the surface area to volume ratio increases drastically as particle size comes down from micro to nano size.
3. Assess the variation of thermal and optical properties of nanomaterials with that of the bulk
4. Show how the shape and size can be controlled in the formation of nanostructures using surfactants
5. Nanomaterials are increasingly being used in various applications. Answer the following questions regarding nanomaterials and technologies:
   (i) Classify the nanomaterials based on the dimensionality and represent with examples.
   (ii) Construct the block diagram of chemical vapour deposition (CVD) method and explain the process of synthesis of nanomaterials using CVD.
   (iii) Model the Electronic band structure and explain photonic crystals.
   (iv) Select any four applications of GaN nanowires and assess their impact on daily life.

(For Open Book Examination and not for semester end examination)

19CE002 Air Pollution and Environmental Impact Assessment

3 1 0 3

Course Outcome

1. Understand basic aspects on air pollution and the quality of atmospheric environment
2. Interpret the different types of air pollution and the means of abatement control
3. Identify the sources for noise pollution and control methods
4. Understand the different steps within environmental impact assessment
5. Compare both orally and in written form the key aspects of environmental impact assessment
6. Explain the examples of EIA in practice with different case studies.

COs–POs Mapping

COs	PO6	PO7	PO12
1	1	2	1
2	1	2	1
3	1	2	1
4	2	1	1
5	2	1	1
6	2	1	1

3-Strongly linked | 2-Moderately linked | 1-Weakly linked

Unit I

Sources and Effects of Air Pollution

Classification of Air pollutants, Particulates and gaseous pollutants, effects of air pollution on human being, materials, animals and vegetation; global warming- ozone layer depletion, sampling and analysis, basic principle of sampling, source of ambient sampling, analysis of pollutants, principles
Sampling of air Pollutants; Ambient air quality standards.

11+4 Hours

Unit II

Air Pollution Control and Noise Pollution

Air Pollution Control: Particulate control by gravitational, centrifugal, filtration, scrubbing, electrostatic precipitation- selection criteria for equipment- gaseous pollutant control by adsorption, absorption, condensation, combustion.
Noise Pollution**:** Sources, Effects, Assessments, Standards and Control Methods, Prevention Methods.
Plume rise behavior ;Measurement of Noise level.

11+4 Hours

Unit III

Environmental Impact Assessment

Impacts of Development on Environment, Environmental Impact Assessment (EIA): Objectives, Historical development, EIA Types, EIA Notification and Legal Framework, Stakeholders and their Role in EIA.
Screening and Scoping in EIA: Drafting of Terms of Reference, Baseline monitoring, Prediction and Assessment of Impact on land, water, air, noise and energy, flora and fauna EIA Methods- Matrices – Networks – Checklist Methods.
Rio Principles of Sustainable Development; Mathematical models for Impact prediction.

12+3 Hours

Unit IV

Environmental Management Plan

Plan for mitigation of adverse impact on water, air and land, water, energy, flora and fauna, Environmental Monitoring Plan, EIA Report Preparation, Review of EIA Reports, and Environmental Clearance.
Case Studies**:** EIA case studies pertaining to Infrastructure Projects, Roads and Bridges, Ports and Harbor, Airports, Dams and Irrigation projects, Power plants, CETPs.
Public Hearing; Post Project Monitoring.

11+4 Hours
Total Hours: 45+15 Hours

Text book (s)

1. M. N. Rao and H. V. N. Rao, Air pollution, Tata McGraw-Hill, New Delhi, 1993 2. N
2. D. Nevers, Air Pollution Control Engineering, McGraw-Hill International Ed., 1993
3. Canter, R.L, "Environmental impact Assessment ", 2nd Edition, McGraw Hill Inc, New Delhi, 1995.
4. 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.
5. Peter Morris, Riki Therivel "Methods of Environmental Impact Assessment", Routledge Publishers,2009

Reference (s)

1. K. Wark, C. F. Warner, Air Pollution, Its Origin and Control, Harper and Row, New York, 1981
2. C. S. Rao, Environmental Pollution Control Engineering, New Age International, 2005
3. Becker H. A., Frank Vanclay, "The International handbook of social impact assessment" conceptual and methodological advances, Edward Elgar Publishing, 2003.
4. Barry Sadler and Mary McCabe, "Environmental Impact Assessment Training Resource Manual", United Nations Environment Programme, 2002.
5. Judith Petts, "Handbook of Environmental Impact Assessment Vol. I and II", Blackwell Science New York, 1998.
6. Ministry of Environment and Forests EIA Notification and Sectoral Guides, Government of India, New Delhi, 2010.

Sample Question(s)

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Open Book Exam (%)
Remember	30	30	-
Understand	70	70	40
Apply	-	-	60
Analyze	-	-	-
Evaluate	-	-	-
Create	-	-	-
Total (%)	100	100	100

Remember

1. Classify Air Pollutants
2. Define Wind Rose
3. give the plume rise behavior formula
4. Define EIA
5. What are the objectives of Environmental Impact Assessment (EIA)?

Understand

1. Briefly discuss about the various types of gases in air pollution
2. Discuss in detail about effects of air pollution on environment
3. What are the basic concepts of EIA?
4. Explain the various steps in preparing of E1A report.
5. Explain in detail about different methods used in EIA

Apply

1. A plate type ESP use in a cement plant for removing dust particles consist of 10 equal channels. The spacing between plates is 15 cm and the plates are 3 m high and 3 m long. Unit handles 20,000 m^3 /h of gas. a) What is the efficiency of collection plates? b) What is the collection rate of particles having density 9.2 gm/m3? c) What should be the length of the plate for achieving efficiency of 99% keeping another parameter same? (**For Open Book Examination and not for semester end examination**)
2. A highway project is proposed between Visakhapatnam to Bhubaneswar. It is recommended to prepare an environmental impact assessment report for the proposed project by considering all parameters. **(For Open Book Examination and not for semester end examination)**

19EE002 Renewable Energy Sources

3 1 0 3

Course Outcomes

1. Outline the operation of solar energy system
2. Summarize the operation of wind and biomass energy systems
3. Develop solar/wind energy systems for a given application
4. Interpret working principles of geothermal energy system
5. Summarize the operation of ocean, tidal, fuel cells, small hydro and magneto hydro energy system
6. Extend renewable energy sources to direct energy conversions & micro grids

COs – POs Mapping

COs	PO_2	PO_7
1	2	3
2	2	3
3	3	3
4	2	3
5	2	3
6	2	3

3–Strongly linked | 2–Moderately linked | 1–Weakly linked

Unit I

Introduction & Solar Energy

Introduction to renewable energy, advantages of generating power through renewable energy sources – technical & economical, Solar Energy: Physics of sun, the solar constant, extra-terrestrial and terrestrial solar radiation, instruments for measuring solar radiation and sun shine. Flat Plate and Concentrating Collectors, classification of concentrating collectors, thermal analysis of flat plate collectors, Photo voltaic energy conversion, PV cell model and characteristics, Maximum power point tracking for photovoltaic power systems. Types of Maximum power point tracking methods Perturb and Observe.

Solar applications-solar heating /cooling technique

12+4 Hours

Unit II

Wind & Bio-Mass Energy

Sources and potentials, horizontal and vertical axis windmills, performance characteristics, Betz criteria, Maximum power generation. Principles of Bio-Conversion, Anaerobic/aerobic digestion, Types of Bio-Gas Digesters, gas yield, Combustion characteristics of bio-gas.

Utilization for cooking, IC Engine operation

12+4 Hours

Unit III

Geothermal & Ocean Energy

Types of Resources (hydrothermal, geo-pressured, hot dry rock), types of wells, and methods of harnessing the energy (Vapour dominated, liquid dominated), Ocean thermal energy conversion, principles, Open loop & closed loop OTEC Cycles. Tidal energy- potential, conversion techniques-single basin, two basin system. Wave energy: conversion techniques.

Captive power plant

11+4 Hours

Unit IV

Direct energy conversion & introduction to Micro-grid

Fuel cells-Principle of working of various types of fuel cells and their working, Hydrogen generation, battery energy storage system. Magneto-hydrodynamics (MHD)

Define grid, microgrid, importance of DG & microgrid, typical structure and configuration of a microgrid, AC and DC microgrids, modes of operations (grid connected & islanded).

Distributed generation (DG)

10+3Hours

Total: 45+15=60 Hours

Text Book(s):

1. G.D. Rai, "Non-Conventional Energy Sources", Khanna Publishers, 2nd Edition, 2017.
2. B H Khan, "Non-conventional energy resources", Tata McGraw Hill Education Private Limited, 3rd Edition, 2015.

3. Alexis Kwasinski , Wayne Weaver, Robert S. Balog, "Micro grids and other local area power and energy systems", Cambridge University Press, 1st Edition, 2016

Reference Book(s):

1. Tiwari and Ghosal, "Renewable energy resources", Narosa Publishing house, 2ndEdition, 2001
2. Ranjan Rakesh, Kothari D. P. & Singal K. C., "Renewable Energy Sources and Emerging Technologies", PHI, 2nd Edition, 2013.
3. Nikos Hatziargyriou, "Micro grids: Architectures and Control", Wiley, 1st Edition.
4. Electricity Act 2003, Renewable Energy Act 2015.
5. Indian Constitution-Articles 51A, 47, 48A.

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Open Book Examination (%)
Remember	40	40	---
Understand	60	60	50
Apply	---	---	50
Analyze	---	---	---
Evaluate	---	---	---
Create	---	---	---
Total (%)	100	100	100

Sample Question (s)

Remember

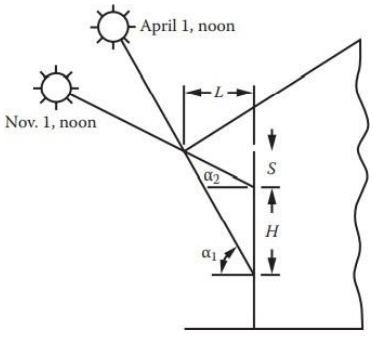
1. Define renewable energy
2. List out the advantages HAWT
3. List out the disadvantages non concentration collector
4. Define solar radiation
5. Define micro-grid

Understand

1. Explain need of micro-grid
2. Interpret faraday's laws
3. Explain closed loop OTEC Cycles system
4. Explain Principle of working of MHD Power plant
5. Compare HAWT and VAWT

Apply

1. Compute the power coefficient of wind turbine
2. Demonstrate storage of energy from battery
3. Assess magnetic flux density due to circular ring
4. Compute solar cell working
5. Assess the nature of micro-grid
6. a) Find the roof overhang L of a south-facing window of height H = 1 m, such that the window is completely shaded at solar noon on April 1 and not shaded at all at noon on November 1. Assume that the roof extends far beyond the window on either side. Location: Gainesville, Florida. Also, find the overhang if S = 1.3 m from the below figure.



b) Repeat the above example for Canberra, Australia, for a north-facing window, such that the window is completely shaded at noon on November 1 and completely lit at noon on April 1.**(For Open Book Examination and not for semester end examination)**

7. Find the solar altitude and azimuth angles at solar noon in i) Gainesville, Florida, on February 1 ii) Canberra, Australia on February 1. Also find the sunrise and sunset times in Gainesville on that day. Since the sunrise and sunset times are calculated when the center of the sun is at the horizon, they differ from the apparent times. If we use $\alpha = -50'$, the apparent sunrise and sunset times would be 7:20 a.m. EST and 6:06 p.m. EST, respectively. **(For Open Book Examination and not for semester end examination)**

8. As a technical engineer you are appointed in a planning and commission team of govt of India. The duty has been assigned that the Leh and Ladakh people are suffering electricity problem from decade. The NDA government has declared that the power generation plant has to be operated there within a year with 10 MW generation in only renewable energy aspect.

(i) Propose the type of plant which is more suitable to that area and having uninterrupted power supply with grid connection mode

(ii) Describe the advantages of that plant compared to conventional energy sources

(iii) What's are the measure precautions to be taken for that plant operation and maintenance purpose.

(iv) Give the details constructional block diagram of the power plant.

(For Open Book Examination and not for semester end examination)

19ME002 Principles of Entrepreneurship

3 1 0 3

Course Outcomes

1. Explain the role of entrepreneur in economic development
2. Demonstrate methods of generating ideas
3. Develop the business plan to start enterprises
4. Analyze various production aspects such as manufacturing costs control, marketing management and waste reduction strategies
5. Assess financial and marketing plans and control for enterprises
6. Find the institutional support for entrepreneurship

COs POs Mapping

COs	PO_1	PO_{11}
1	3	2
2	3	-
3	3	3
4	3	2
5	3	3
6	3	3

3 Strongly linked, 2 Moderately linked , 1 Weakly linked

Unit I

Introduction to Entrepreneurship Definition of Entrepreneur, Entrepreneurial Traits, Entrepreneur Vs. Manager, Entrepreneur Vs Entrepreneur. The Entrepreneurial decision process- Role of Entrepreneurship in Economic Developments, Ethics and Social responsibility of entrepreneurs, Woman as entrepreneur. *Opportunities for entrepreneurs in India and abroad*

11+4 Hours

Unit II

Creating and starting the venture Sources of new Ideas, Methods of generating ideas, creating problems solving- Product planning and development process The business plans Writing Business plan, Evaluating Business plans, Using and implementing business plans, marketing plan, financial plan and the organizational plan launching formalities.

Nature and scope of business plan

11+4 Hours

Unit III

Financing and managing the new venture Source of Capital, record keeping, recruitment, motivating and leading teams, financial controls, Marketing and sales controls. E Commerce and Entrepreneurship New venture expansion strategies and issues Features evaluation of joint ventures, acquisitions, merges, franchising, Public issues, rights issues, bonus issues

Internet advertising

11+4 Hours

Unit IV

Institutional support Entrepreneurship Role of Dire crate of Industries, District Industries, Centers (DICS), Industrial development Corporation (IDC), state Financial corporation (SFCs), Small Scale Industries Development Corporations (SSIDCs), Khadi and village Industries Commission (KVIC), Technical Consultancy Organization (TCO), small Industries Service Institute (SISI), National Small Industries Corporation (NSIC), Small Industries Development Bank of India (SIDBI), salient provision under Indian Factories Act, Employees State Insurance Act, Workmen‟s Compensation Act and payment of Bonus Act.

Labor legislation

12+3 Hours

Total: 45+15 Hours

Textbook (s)

1. Robert Hisrich & Michael Peters, Entrepreneurship, TMH, 5th Edition, 2009.
2. Dollinger, Entrepreneurship, Pearson Education, 4th Edition, 2004.
3. Robert J. Calvin, Entrepreneurial Management, Tata McGraw-Hill Education, 2004.

4. Vasant Desal, The Dynamics of Entrepreneurial Development and Management Himalaya publishing House, 5th Edition, 2017.
5. Kaplan, Patterns of Entrepreneurship, Willey, 4th Edition, 2005

Reference (s)

1. William A. Sahlman, James Stancill, Arthur Rock, Harvard Business Review on Entrepreneurship, Harvard Business School Press, Revised Edition, 2019.
2. Gurmeet Naroola, The Entrepreneurial Connection: East Meets West in the Silicon Valley, Special edition, TiE, 2001.
3. Bill Bolton & John Thompson, Entrepreneurs Talent, Temperament, Technique, Routledge, 7nd Edition, 2016.
4. Agrawal, A.N. & Agarwal, M.K., Indian Economy: Problems of Development and Planning, New Age International, 42nd Edition, 2017.
5. Gaurav Datt & Ashwani Mahajan, Dutt & Sundaram‟s Indian Economy, S. Chand, 72nd Edition, 2016. 5. Srivastava, Industrial Relations Labour Laws, Vikas Publishing House, 6th Edition, 2005.
6. Aruna Kaulgud, Entrepreneurship Management by Vikas publishing house, 2003.
7. Thomas W. Zimmerer & Norman M. Scalbrorough, Essential of Entrepreneurship and small business management, PHI, 4th Edition, 2005.
8. Mary Coulter, Entrepreneurship in Action, PHI 2nd Edition, 2005.
9. ND Kapoor, Industrial Law, Sultan Chand & Sons, 14th Revised Edition, 2013.

Sample Question (s)

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Open book examination (%)
Remember	30	40	-
Understand	70	60	40
Apply	-	-	60
Analyze	-	-	-
Evaluate	-	-	-
Create	-	-	-
Total (%)	100	100	100

Remember

1. List the different methods of generating ideas and explain any four methods.
2. List the difference between entrepreneur vs manager.
3. What are the objectives of market research?
4. What are the market research activities? List them.
5. List the important functions of IDBI.

Understand

1. Compare between entrepreneur vs manager.
2. Illustrate the characteristics or traits of an entrepreneur.
3. Outline the sources of new ideas for entrepreneur.
4. Explain the various steps involved in writing a business plan.
5. Summarize the various sources of capital required for business venture.
6. Demonstrate the role of E-commerce in entrepreneurship with its applications.
7. Illustrate marketing plan and financial plans required for an entrepreneur.
8. Show the factories act 1948.
9. Rephrase the reasons for the need of labor legislation becomes important.

Apply

1. Develop the business plan to establish a startup by taking an industrial case.
2. Identify the various sources of capital required to meet the new ideas of an entrepreneur for the economic development of a business venture.
3. Organize the role of entrepreneur in choosing the institutional supports to entrepreneurship.

4. In recent years, the entrepreneurial educator and author Steve Blank began applying lean startup principles to various US governmental agencies. Through a Hacking for Diplomacy course, students at Stanford University began tackling problems for the Department of State. A former US ambassador to the United Nations, a State Department representative to Silicon Valley and senior advisor for technology and innovation, a retired US Army colonel, and other entrepreneurial educators joined Blank in applying lean startup methods to State Department issues. Then Secretary of State John Kerry even visited the Stanford students and said he was looking forward to the solutions students develop during the ten weeks. One project that emerged was from a group calling themselves Team Space Evaders. The team was tasked with working on the problem of satellite collision. Members charted satellite positioning data and explored how information about potential collision was shared by commercial operators and governmental entities ranging from the Federal Aviation Administration to the Department of Defense.
    a. Apply the lean startup methodology to identify potential customer segments and problems and solutions that students such as yourself could identify for the State Department on the issue of satellite collision.
    b. Choose a unique value proposition for a State Department solution to this issue. Identify a high-level concept pitch work when selling the concept within the State Department?

19EC002 Electronics for Agriculture

3 1 0 3

Course Outcomes

1. Illustrate various sensors and electrical motors for agricultural sector.
2. Explain the modern remote sensing technology for the agricultural development.
3. Predict the diversity of precision farming
4. Demonstrate the importance of electrical and instrument technology for the benefits of agricultural development.
5. Interpret environmental parameters with Electronics systems
6. Assess advanced agricultural technologies.

COs – POs Mapping

COs	PO_1	PO_2
1	2	-
2	2	-
3	3	2
4	3	2
5	2	-
6	3	2

3–Strongly linked | 2–Moderately linked| 1–Weakly linked

Unit I

Instrument technology for agriculture

Instrument for measurement: pH, Electrical conductivity, gas analysis, humidity, leaf area, chlorophyll content and soil moisture & temperature. Use of electrical energy in agriculture, electromechanical energy conversion, Electrical motors, Selection of motors for different farming applications, renewable energy sources.

Importance of pH value, Environmental issues

11 + 3 Hours

Unit II

Precision Farming

An introduction to precision farming. GIS/GPS positioning system for precision farming, Yield monitoring and mapping, soil sampling and analysis, Computers and Geographic information systems, Precision farming-Issues and conditions, Role of electronics in farm machinery for precision farming.

Agriculture and Forestry investigations, Atmospheric investigation,

12+ 4Hours

Unit III

Electronics in Agriculture Instrument for crop monitoring – moisture measurement – capacitive, infrared reflectance and resistance. Monitoring soil and weather – measurement of soil properties and meteorological parameters – irrigation control systems. Instruments for crop establishment monitoring. Crop spraying – selective crop spraying – flow control. Yield monitoring. Technology for precision farming. Instruments for protected cultivation – green house environment control – transducers and control system. Instruments and systems for crop handling processing and storage.

Role of engineering in agricultural sector, Electronic control system for grape drying process

12+ 3 Hours

Unit IV

Advanced Agricultural Technologies: Difference between traditional and modern agricultural practices; Internet of Things (IoT), Online Marketing of agro based products, Information and Communication Technology (ICT), Mobile Technology, Agricultural Drones & Robotics, Artificial Intelligence (AI) based farming.

Governance services in agriculture sector, Role of Electronics Governance in Agricultural sector.

10+ 5 Hours

Total: 45+15 Hours

Text Books

1. Curtis Johnson, "Process Control Instrumentation Technology"; 8th Edition, Pearson Education
2. Kuhar, John. E. 1977. The precision farming guide for agriculturalist. Lori J. Dhabalt, USA

Reference Books

1. De Mess M. N. Fundamental of Geographic Information System. John Willy & sons, New York, Datta S.K.1987.
2. K. Krishna Swamy, "Process Control"; New Age International Publishers
3. Manual of Soil & Water conservation Engineering. Oxford & IBH Co. Sigma & Jagmohan, 1976.

SAMPLE QUESTION (S)
Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Open book Examination (%)
Remember	25	20	--
Understand	45	30	60
Apply	30	45	40
Analyse	--	--	
Evaluate	--		--
Create	--		--
Total (%)	100	100	100

Remember

1. List the use of electrical energy in agriculture.
2. List the sensors used to access various parameters in agriculture.

Understand

1. Illustrate the use of ICT in Online marketing of agro based products.
2. Illustrate the use of Agricultural Drones & Robotics in agriculture.

Apply

1. Demonstrate the role of GPS positioning system for precision farming.
2. Demonstrate the process involved in modern agricultural practice.

[Open Book Examination Questions]

19CS002 Fundamentals of Machine Learning

3 1 0 3

Course Outcomes:

1. Classify the variety of learning algorithms.
2. Choose a learning algorithm to data using various tools of Machine Learning.
3. Identify the strengths and weaknesses of many popular machine learning approaches.
4. Examine the performance of learning algorithms and model selection.
5. Identify mathematical relationships within and across Machine Learning algorithms and the paradigms of supervised and unsupervised learning.
6. Model Artificial Neural Networks and Deep Neural Networks in solving complex real-world problems.

COs–POs Mapping

CO	PO2	PO5
1	1	2
2	3	2
3	3	1
4	3	2
5	3	2
6	2	2

3–Strongly linked | 2–Moderately linked | 1–Weakly linked

UNIT I

Overview of Machine Learning, **Learning**: Types of Machine Learning, Hypothesis Formulation and Model Selection, **Phases of ML**: Training, Testing and Validation-Splitting, Cross Validation; **Evaluation of Machine Learning Models:** Error Analysis, Performance Indices, Confusion Matrices, The Bias-Variance Trade-off, Feature Selection; **Regression**: Linear Regression, Linear Regression with Multiple Variables, Logistic Regression.
Basic Statistics: Variance and Covariance, Correlation Vs Regression, Feature Scaling and Standardisation, Machine Learning Tools: Weka, R, Python, MATLAB.

12+4 Hours

UNIT II

Learning with Trees: Constructing Decision Trees, ID3 Classifier, Constructing Rules from a Decision Trees Classification; **Graphical Models**: Bayes' Theorem, Bayesian Learning, Bayesian Networks, Naïve-Bayes Classifier, **Instance based Learning**: Nearest Neighbor Classifiers.
Modelling a Supervised Learning System, Conditional Probability

10+3 Hours

UNIT III

Clustering: Similarity and Distance Measures, **Clustering Techniques**: K-Means Algorithm, Hierarchical Clustering, Clustering of Categorical Attributes; **Dimensionality Reduction**: Linear Discriminant Analysis, Principal Component Analysis; **Ensemble Learning**: Boosting, Bagging, Stacking.
Comparision of Clustering Techniques, Curse of Dimensionality

12+4 Hours

UNIT IV

Artificial Neural Networks: Model, Activation functions, Perceptron, The Multilayer Perceptron (MLP), Error Propagation, Delta Rule, Back Propagation Algorithm, **Deep Learning**: Convolutional Neural Networks (CNN), Applications, A case study on Object Recognition using CNN.
Linear Separability, Gradient Descent, XOR Gate

11+4 Hours
Total: 45+15 Hours

Textbook (s)

1. Stephen Marsland, "Machine Learning: An Algorithmic Perspective", (Chapman & Hall/CRC Machine Learning & Pattern Recognition), Second Edition, 2014.

2. Sunila Gollapudi and Rodolfo Bonnin, “Practical Machine Learning: Experimental algorithms and techniques for machine learning and artificial intelligence”, Packt Publishing Ltd., Mumbai, Second Edition, 2018.

Reference (s)

1. Tom M. Mitchell, "Machine Learning ", Tata McGraw Hill, New Delhi, 2017.
2. Raschka Sebastian and Mirjalili Vahid, “Python Machine Learning: Machine Learning and Deep Learning with Python, scikit-learn, and TensorFlow 2”, Packt Publishing Ltd., Mumbai, 3rd Edition, 2019.
3. Ian Goodfellow, Yoshua Bengio, Aaron Courville, “Deep Learning”, The MIT Press, 2016

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Open Book Examination[1] (%)
Remember	40	30	--
Understand	40	40	--
Apply	20	30	80
Analyze	--		20
Evaluate	--	--	--
Create	--	--	--
Total (%)	100	100	100

SAMPLE QUESTION (S)

Remember

1. Define Machine Learning.
2. List the types of Machine Learning.
3. State Bayes Theorem.
4. What is Regularization?

Understand

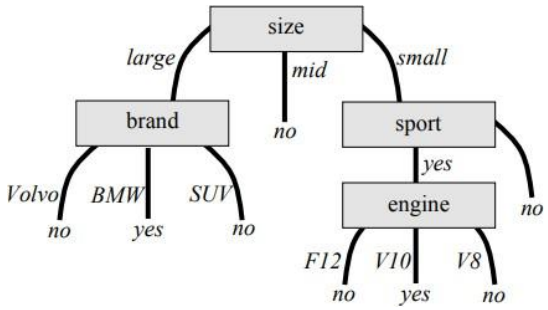
1. Demonstrate Linear Regression.
2. Explain Back Propagation Algorithm.
3. Illustrate Decision Tree Induction process in detail.
4. Demonstrate Genetic Operations in detail.

Apply

1. Apply the concept of Regularization to solve overfitting problem.
2. Build a Linear Regression for a given dataset.
3. Apply k-Means algorithm on a given dataset to identify clusters.
4. Apply Back Propagation Algorithm to the the given dataset.

Open Book Examination

1. Suppose that we want to solve the problem of finding out “*what a good car is*” by using Decision Tree algorithm.



a) Generate rules from the constructed decision tree?
b) Which parameters required for generating the tree?
c) What would be the suitable values of those parameters for the given problem? Provide a short explanation for each.
d) Explain your answer in a clear and compact manner by providing the pseudo code of the algorithm

2. About 2/3 of your email is spam so you downloaded an open source spam filter based on word occurrences that uses the Naive Bayes classifier. Assume you collected the following regular and spam mails to train the classifier, and only three words are informative for this classification, i.e., each email is represented as a 3-dimensional binary vector whose components indicate whether the respective word is contained in the email.

'study'	**'free'**	**'money'**	**Category**
1	0	0	Regular
0	0	1	Regular
1	0	0	Regular
1	1	0	Regular
0	1	0	Spam
0	1	0	Spam
0	1	0	Spam
0	1	0	Spam
0	1	1	Spam
0	1	1	Spam
0	1	1	Spam
0	1	1	Spam

a) You find that the spam filter uses a prior p(spam) = 0.1. Explain why this might be sensible.
b) Give the following model parameters when estimated as maximum-likelihood with add-one smoothing (i.e., using pseudocounts of one).
P(study|spam), P(study|regular), P(free|spam), P(free|regular), P(money|spam), P(money|regular)
c) Based on the prior and conditional probabilities above, give the model probability P(spam|s) that the sentence s="money for psychology study" is spam.
d) What should be the value of the prior p(spam) if we would like the above sentence to have the same probability as being spam as not spam, i.e., it would be classified as spam with probability 0.5?

19CH002 Industrial Safety and Hazard Management

3 1 0 3

Course Outcomes

1. Demonstrate the safety and ethical issues that may arise from industrial processes
2. Explain industrial hygiene practices and its procedures
3. Illustrate the toxic pathways and elimination of toxicity on bio organisms
4. Understand hazards arising from runaway reactions, explosions and fires, and how to deal with them.
5. Choose a suitable method for prevention of fires and explosions
6. Explain the process and able to do Hazards Identification and risks Risk Assessment

COs – POs Mapping

COs	PO_1	PO_2	PO_3	PO_6	PO_8
1	2	2	1	3	3
2	1	2	1	3	3
3	3	2	3	1	1
4	3	1			
5	3	3	3		2
6	3	3	3	3	2

3–Strongly linked | 2–Moderately linked | 1–Weakly linked

Unit I

Introduction to Safety & Industrial Hygiene

Safety programs, Engineering ethics, Accident and Loss Statistics, Acceptable Risk, Public Perceptions, The nature of the Accident Process, Inherent Safety, Government of India and OSHA regulations, Industrial Hygiene, Identification, Evaluation & Control

Lethal dosage–Material Safety Data Sheets

12+4 Hours

Unit II

Toxicology, Fires and Explosions

how toxicants enter biological organisms, how toxicants are eliminated from biological organisms, effects of toxicants on biological organisms The fire triangle, Distinction between fire and explosions, Definitions, Flammability characteristics of liquids and vapors, MOC and inserting, ignition energy, Auto ignition, Auto oxidation, Adiabatic compression, Explosions

Firefighting equipment–Personal protecting equipment–Building fire safety codes

11+3 Hours

Unit III

Designs to Prevent Fires and Explosions

Inerting, static electricity, controlling static electricity, explosion proof equipment and instruments, ventilation, sprinkler systems, miscellaneous designs for preventing fires and explosions

Work permit–Earthling–Color codes for identification of process

10+4 Hours

Unit IV

Hazards Identification and Risk Assessment

Process hazards checklists, hazards surveys, hazards and operability studies, safety reviews, other methods. Review of probability theory, event trees, fault trees, QRA and LOPA

Health and safety foundation–5S Practice–Emergency procedures

12+4 Hours

Total: 45+15 Hours

Text book (s)

1. D. A. Crowl, J. F. Louvar, Chemical Process Safety: Fundamentals with Applications, 3rd Ed., Prentice Hall, 2011
2. Reese, Charles D. Industrial Safety and Health for People-oriented Services. CRC Press, 2008

Reference (s)

1. H.H.Fawcett and W.S.Wood, Safety and Accident Prevention in Chemical Operations, John Wiley and sons, 2nd Ed., New York, 1982
2. Hammer, Willie, and Dennis Price. Occupational Safety Management and Engineering. Pearson College Division, 2001
3. R. K. Sinnot, Coulson and Richardson's Chemical Engineering series Vol.6, Butterworth–Heinmann Ltd. 1996

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Open book Examination (%)
Remember	20	20	20
Understand	50	40	30
Apply	30	40	50
Open book Questions	--	--	--
Evaluate	--		--
Create	--	--	--
Total (%)	100	100	100

Sample Question (s)
Remember

1. Define terms hazard and accidents
2. List three-step of accidents process?
3. Define terms LD and ED
4. Define any two methods of representation of toxicants dose concentration
5. List any four reversible effects that caused by toxic exposure
6. Describe four phases in any industrial hygiene
7. Define terms risk, loss prevention

Understand

1. Identify the initiation, propagation, and termination steps for motor accident
2. Would you say chemicals do more good than harm, more harm than good, or about the same amount of each?
3. Explain about how toxicants enter biological organisms
4. Explain the key responsibilities' of professional engineers
5. Explain the inherent safety techniques that are used in the chemical industry
6. Explain how toxicants are eliminated from biological organisms
7. List the ingredients of safety program for outstanding safety program

Apply

1. An employee works in a plant with a FAR of 4. If this employee works a 4-hr shift, 200 days per year, what are the expected deaths per person per year?
2. Air contains 5 ppm of diethylamide (TLV-TWA of 5 ppm), 20 ppm of cyclohexanol (TLV-TWA of 50 ppm), and 10 ppm of propylene oxide (TLV-TWA of 2 ppm). What is the mixture TLV-TWA and has this level been exceeded?
3. The following accident report has been filed. Failure of a threaded 1½″ drain connection on a rich oil line at the base of an absorber tower in a large (1.35 MCF/D) gas producing plant allowed the release of rich oil and gas at 850 psi and −40°F. The resulting vapor cloud probably ignited from the ignition system of engine driven re compressors. The 75′ high × 10′ diameter absorber tower eventually collapsed across the pipe rack and on two exchanger trains. Breaking pipelines added more fuel to the fire. Severe flame impingement on an 11,000-horsepower gas turbine–driven compressor, waste heat recovery, and super-heater train resulted in its near total destruction. Identify the initiation, propagation, and termination steps for this accident
4. A process has a reported FAR of 2. If an employee works a standard 8-hr shift 300 days per year, compute the deaths per person per year

19IT002 Fundamentals of Cloud Computing

3 1 0 3

Course Outcomes

1. Interpret the main concepts, key technologies, strengths, and limitations of cloud computing and the possible applications for state-of-the-art cloud computing
2. Illustrate various problems and evaluate related cloud computing solutions.
3. Apply the architecture and infrastructure of cloud computing, including SaaS, PaaS, IaaS, public cloud, private cloud and hybrid cloud to different problems.
4. Understand cloud provider for a defined environment and to a specific platform in a cost effective way.
5. Apply case studies to derive the best practice model to apply when developing and deploying cloud based applications
6. Understand a virtual machine with a machine image

Co – Po Mapping

COs	PO_1	PO_7
1	3	1
2	3	1
3	3	1
4	2	2
5	3	1
6	2	3

3–Strongly linked | 2–Moderately linked | 1–Weakly linked

Syllabus

Unit I

Understanding Cloud Computing

Cloud computing: Introduction, Cloud application architectures, Value of cloud computing, Cloud Infrastructure models, Cloud Services, History of Cloud Computing, Advantages of Cloud Computing, Disadvantages of Cloud Computing, Companies in the Cloud Today, Amazon Web Services, Windows Azure, Google services, IBM Cloud Before the move into the cloud- Know Your Software Licenses, The Shift to a Cloud Cost Model, Service Levels for Cloud Applications Ready for the cloud: Web Application Design, Machine Image Design, Privacy Design, Design, Database Management.

Tata Cloud- Salesforce.com

13+3 Hours

Unit II

Virtual Machines and Virtualization of Clusters and Data Centers

Implementation Levels of Virtualization, Virtualization Structures/Tools and Mechanisms, Virtualization of CPU, Memory, and I/O Devices, Virtual Clusters and Resource Management, Virtualization for Data-Center Automation Case Studies: Cloud centers in detail, Comparing approaches, Xen, Eucalyptus, Cloud Stack, and Open Stack

VMware- KVM.

10+5 Hours

Unit III

Cloud Computing Software Security Fundamentals

Cloud information Security Objectives, Cloud Security Services, Relevant Cloud Security Design Principles, Secure Cloud Software Requirements, Approaches to Cloud Software Requirements Engineering, Cloud Security Policy Implementation. Cloud Computing Risk Issues: The CIA Triad, Privacy and Compliance Risks, Threats to Infrastructure Data and Access Control, Cloud Access Control Issues, Cloud Service Provider Risks.

Security concepts-Confidentiality-privacy-integrity-authentication-non-repudiation-availabilit- access control- defense in depth- least privilege

12+4 Hours

Unit IV

Cloud Programming and Software Environments

Features of Cloud and Grid Platforms, Parallel and Distributed Programming Paradigms, Programming Support of Google App Engine, Programming on Amazon AWS and Microsoft Azure, Emerging Cloud Software Environments.

Ubiquitous Cloud: Cloud Trends in supporting Ubiquitous Computing, Performance of Distributed Systems and the Cloud.

10+3 Hours
Total: 45+15 Hours

Textbook (s)

1. George Reese, Cloud Application Architectures, 1st Edition O'Reilly Media, 2009
2. Ronald L.Krutz and Russell Dean Vines, Cloud Security, 1st Edition, Wiley Publishing, 2010

Reference (s)

1. Michael Miller, Cloud Computing-Web Based Applications that change the way you work and collaborate online, 1st Edition, Pearson Education, Publishing, 2011
2. Kai Hwang, Geoffrey C Fox and .Jack J.Dongarra, Distributed & Cloud Computing from Parallel Processing to the Internet of Things , 1st Edition, MK Publishing, 2010
3. David S Linthicum, Cloud Computing and SOA Convergence in Your Enterprise: A Step-by-Step Guide, 1st Edition, Addison-Wesley, 2009

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Open Book Exam (%)
Remember	40	45	--
Understand	40	45	60
Apply	20	10	40
Analyze	--	--	
Evaluate	--	--	--
Create	--	--	--
Total (%)	100	100	100

Sample Question (S)
Remember

1. Define Cloud Computing
2. List types of virtualization
3. Define proactive scaling
4. What is CIA Triad?

Understand

1. Explain different cloud Infrastructure models
2. Explain different levels of virtualization
3. Explain about cloud Network security in detail?
4. Explain about Recovery Point Objective.

Apply

1. Explain any IaaS service provided by Amazon
2. What is cloud Stack?
3. How disaster recovery planning can be done
4. How Web Application Design is used in designing cloud applications

19BS002 Advanced Numerical Techniques

3 1 0 3

Course Outcomes

1. Apply the knowledge of finding roots of nonlinear equations and different errors in series approximations.
2. Understand the consistency and inconsistency of linear system of equations.
3. Evaluate the solution of Initial and Boundary value problems.
4. Perform numerical differentiation and integration.
5. Analyze the solution of PDEs under given conditions.
6. Apply Knowledge of numerical techniques to Engineering problems.

COs–POs Mapping

COs	PO_1	PO_2
1	3	2
2	3	2
3	3	3
4	3	2
5	3	3
6	3	3

3–Strongly linked | 2–Moderately linked | 1–Weakly linked

Unit I

Errors in numerical calculations and Solutions of algebraic and transcendental equations

Absolute, relative and percentage errors, a general error formula, errors in a series approximationLocating Roots of Equations with one variable: Secant method, Muller's method Solution of nonlinear equations - Introduction, Iteration method, Newton-Raphson method *Bisection method, Regula Falsi method, Order of convergence.*

12+3 Hours

Unit II

Solution of Linear Systems and Interpolation

Direct methods -LU Decomposition, Iterative methods –Jacobi method, Gauss-Seidel method

Interpolating polynomials using finite differences- Bessel interpolation, Piecewise and spline interpolation -Piecewise Linear interpolation, Quadratic spline interpolation

Matrix inversion method, Lagrange and Newton's divided difference interpolation formula.

11+4 Hours

Unit III

Numerical Integration and BVP (ODE)

Newton-Cotes methods (Weddle's rule)
Solution of BVP - Finite difference method, shooting method, the cubic spline method
Trapezoidal Rule, Simpson's 1/3 Rule and Simpson's 3/8 Rule.

11+4 Hours

Unit IV

Numerical solutions of PDEs

Introduction, Finite difference approximations to derivatives, Solutions of Laplace & Poisson equations using Jacobi's, Gauss-Seidel & SOR methods. Solution of parabolic equation using -Bender-Schmidt & Crank-Nicolson methods. Solution of hyperbolic equation
Classification of second order partial differential equations, Canonical forms.

11+4 Hours

Total: 45+15Hours

Textbook(s)

1. M. K. Jain, S.R.K. Iyengar, R.K. Jain, Numerical methods for Scientific and Engineering Computation, 4th edition, New Age International publishers, New Delhi.
2. S.S.Sastry, Introductory methods of numerical analysis, 4th Edition, PHI.
3. B. S. Grewal, Higher Engineering Mathematics, 42nd edition, Khanna publishers, New Delhi.

Reference(s)

1. S. C. Chapra& R. P. Canale, Numerical Methods for Engineers, 6th Edition, McGraw Hill, 2012.
2. Cleve Moler, Numerical Computing with MATLAB, SIAM.

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Open Book Exam (%)
Remember	30	30	-
Understand	40	40	-
Apply	30	30	100
Analyze	--	--	
Evaluate	--	--	
Create	--	--	--
Total (%)	100	100	100

Sample Question(s)

Remember

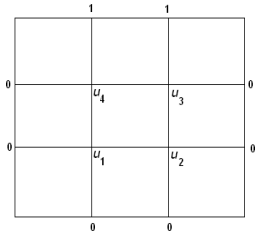
1. List out different Errors in Numerical calculations.
2. List the three numerical methods to solve Algebraic and Transcendental equations.
3. Define initial and boundary value problem for Ordinary differential equations.
4. List the numerical methods in solving Laplace's, partial differential equations i.e. Parabolic and hyperbolic.

Understand

1. Summarize the Absolute, relative and percentage Errors.
2. Illustrate the procedure for Newton-Raphson method for finding root of an algebraic equation.
3. Explain the mechanism involved in LU decomposition method in solving linear system.
4. Explain spline interpolation formula.

Apply

1. Given $f(x) = \sin x$, construct the Taylor series approximations of orders 0 to 7 at $x = \pi/3$.
2. Apply Newton-Raphson method to find a root of the equation $x^3 - 2x - 5 = 0$.
3. Given the set of data points (1,-8), (2,-1) and (3, 18) satisfying the function $y = f(x)$, find the linear splines.satisfying the given data. Determine the approximate values of y(2.5) and $\dot{y}(2)$.
4. Apply Gauss-Seidel's method to solve Laplace equation for the region given in the figure.



19BS003 Functional Materials and Applications

3 1 0 3

Course Outcomes

1. Understand crystal structures of various solids.
2. Explain the X-ray diffraction and it's use in the study of solids.
3. Acquire knowledge of Dielectric materials and their applications.
4. Discuss magnetism, different magnetic materials and their properties.
5. Demonstrate the applications of magnetic materials.
6. Summarize core knowledge and applications of various new materials.

COs–POs Mapping

COs	PO1	PO7
CO_1	3	2
CO_2	3	2
CO_3	3	2
CO_4	3	2
CO_5	3	2
CO_6	3	2

3 – Strongly Correlating; 2 – Moderately Correlating & 1 – Weakly Correlating

Unit I

Crystal structures

Classification of Solids – Amorphous and Crystalline, Lattice Points and Space Lattice - Basis and Crystal Structure, Unit cell, Premitive cell, Crystal Systems and Bravais Lattices, Common Crystal Structures: Diamond, Zinc Blende, NaCl and CsCl Structure - Directions, Planes and Miller Indices, Separation Between Lattice Planes in a Cubic Crystal, X-Ray Diffraction – Brag's Law, Reciprocal Lattice, Concept of Brillion Zone, Laue's Equation. Inter Planar Distance - The Laue Method of XRD - The Powder Method - Analysis of Polycrystalline Pattern (Debye-Scherer Method).

Packing fraction and coordination number of SC, BCC and FCC.

11+3 Hours

Unit II

Dielectric Materials

Introduction, Dielectric Materials, Dielectric Constant, Polarization, D, E and P relation, Types of Polarizations, Electronic Polarization, Ionic Polarization, Orientation Polarization, Interfacial or Space Charge Polarization, Local Field or Internal Field, Clausius-Mossotti Equation, Frequency Dependence of Polarization, Piezoelctricity and piezoelectric materials, Types of Dielectric Materials, Dielectric Loss, Dielectric Break Down. Ferroelectric Materials, Applications of Dielectric Materials.

Pyroelectrics, Electrets.

11+4 Hours

Unit III

Magnetic materials

Introduction, Magnetic Permeability, Susceptibility, Magnetization, B, H and M relation, Origin of Magnetism in Materials, Bohr Magneton, Classification of Magnetic Materials (Dia, Para and Ferro magnetics), Weiss theory of Ferromagnetism, Hysteresis of Ferromagnetic Material, Soft and Hard Magnetic Materials, Ferrimagnetic (Ferrites) Materials, Anti-ferromagnetic Materials, Applications of Magnetic Materials - Microwave Applications, Storage and Memory Elements Applications - Magnetoresistance Materials.

Nuclear Magnetic Resonance (NMR) Electron Paramagnetic Resonance (EPR).

11+4 Hours

Unit IV

New Materials

Metallic glasses, Shape Memory Alloys: Copper, Nickel and Titanium based Alloys, Graphene and its Properties - Ceramics: Types and Applications - Composites: Classification, role of Matrix and Reinforcement, Processing of Fibre Reinforced Plastics and Fibre Reinforced Metals - Biomaterials:

hydroxyapatite, PMMA, Silicone, Nanomaterials: ZnO, TiO_2 Properties and Applications - Sensors: Chemical Sensors, Bio-Sensors, Conducting, Semiconducting and Photoresponsive Polymers. *Nanosensors, Application of Nanosensors.*

12+4 Hours
Total: 45+15 Hours

Textbook (s)

1. Charles Kittel Introduction to solid state Physics, John Wiley & Sons, In, 8th edition, 2012.
2. Wahab, M.A. Solid State Physics: Structure and Properties of Materials. Narosa Publishing House, 2009.
3. Raghavan, V. Materials Science and Engineering: A First course,PHI Learning, 2015.
4. Balasubramaniam, R., Callister's Materials Science and Engineering, Wiley India Pvt. Ltd. 2014.

Reference (s)

1. Smith, W.F., Hashemi, J. & Prakash. R. Materials Science and Engineering, Tata Mcgraw Hill Education Pvt. Ltd., 2014.
2. Askeland, D. Materials Science and Engineering, Brooks/Cole Publishing Company 2010.
3. G. L. Hornyak, H.F. Tibbals, J. Dutta , J. J. Moore, Introduction to Nanoscience and Nanotechnology CRC Press, 2008

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Open Book Exam (%)
Remember	25	25	20
Understand	35	35	20
Apply	40	40	60
Analyze			
Evaluate	--	-	-
Create	--	-	-
Total (%)	100	100	100

Sample question (s)

Remember

1. Define Bravais Lattices.
2. List any four applications of dielectric materials.
3. State Bohr Magneton.

Understand

1. Explain the concept of Brillion zone.
2. Differentiate Soft and Hard ferromagnetic materials
3. Describe the processing of fibre reinforced plastics and fibre reinforced metals.

Apply

1. Identify the principle behind the working of X-ray diffraction.
2. Develop the relation between D, E and P in dielectrics.
3. Choose the energies involved in origin of domains in ferromagnetic material.

Open Book Exam Question

1. Discuss uses of Shape memory alloys in health sector.

19CE003 Solid Waste Management

3 1 0 3

Course Outcomes

1. Classify the sources and types of municipal solid wastes
2. Understand the on-site storage methods and source reduction technique
3. Explain the different collection methods and need for transfer station
4. Demonstrate the off-site processing techniques for resources recovery from solid waste
5. Summarize the various disposal methods of solid wastes
6. Understand different types, handling of hazardous waste

COs–POs Mapping

COs	PO3	PO7	PO12
1	2	3	3
2	2	3	3
3	2	3	3
4	3	3	3
5	3	3	3
6	3	3	3

3 – Strongly linked | 2 – Moderately linked | 1 – Weakly linked

Unit I

Basics of Solid Waste

Sources and types of municipal solid waste – Waste generation rates – Factors affecting generation, composition, characteristics – Methods of sampling – Effects of improper disposal of solid wastes – Public health and environmental effects – Elements of solid waste management – Municipal solid waste rules – Role of NGO's, EPA

11+4 Hours

Unit II

Source Reduction, Storage, Collection and Transfer

Source Reduction and Storage: Source reduction of waste – Reduction, Reuse, Recycling and Recover – Segregation of wastes at source – Onsite storage methods – Materials used for containers.

Collection and Transfer: Methods of Collection – types of vehicles – Vehicle time management - Manpower requirement – collection routes; transfer stations – selection of location, operation & maintenance; options under Indian conditions

11+4 Hours

Unit III

Processing and Waste Disposal

Processing: Objectives of waste processing – Physical Processing techniques and Equipment; Resource recovery from solid waste composting and biomethanation; Thermal processing options.

Disposal: Land disposal of solid waste- Sanitary landfills – site selection, design and operation of sanitary landfills – Landfill liners – Management of leachate and landfill gas – Landfill bioreactor – Dumpsite Rehabilitation.

12+3 Hours

Unit IV

Hazardous Waste Management

Basics of Hazardous Waste: Need for hazardous waste management – Sources of hazardous wastes- Characteristics of Hazardous Waste- Effects on community – Basic Terminology and classification – Storage and collection of hazardous wastes.

Types of Hazardous Waste: Types, Classification, Handling, Storage and Disposal of Nuclear Waste, e-Waste, Biomedical waste and Chemical Waste.

11+4 Hours

Total: 45+15 Hours

Textbook (s)

1. George Tchobanoglous and Frank Kreith., "Handbook of Solid waste management", McGraw Hill, New York, 2002
2. John Pitchel., "Waste Management Practices-Municipal, Hazardous and industrial", CRC Press, Taylor and Francis, New York, 2014

Reference (s)

1. CPHEEO, "Manual on Municipal Solid waste management, Central Public Health and Environmental Engineering Organisation", Government of India, New Delhi, 2014
2. William, A. Worrell., P. Aarne Vesilind., "Solid Waste Engineering", Cengage Learning, 2012
3. Ramachandra, T. V., "Management of Municipal Solid Waste", TERI Press, New Delhi, 2009
4. Marc J. Rogoff and Francois Screve., "Waste to Energy Technologies and Project Implementation", Second Edition, Noyes Publication, USA, 2011

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Open Book Exam (%)
Remember	25	25	-
Understand	75	75	100
Apply	-	-	-
Analyze	-	-	-
Evaluate	-	-	-
Create	-	-	-
Total (%)	100	100	100

Sample Question (S)

Remember

1. Define Solid Waste
2. List the need of transfer station
3. List any two onsite processing technique
4. What are the important factors governing the selection of solid waste?
5. List the characteristics of solid waste

Understand

1. Explain in detail about functional elements of solid waste
2. Explain in detail about different components of landfill
3. Explain in detail about source, types, handling and disposal methods of biomedical waste.
4. A city is having a population of 10 lakhs. Suggest a suitable storage system by dividing into different zone, develop a collection routes with all its components (collection time, frequency, manpower and type of vehicle). It is also required to adopt a suitable onsite processing technique and best disposal methods for the solid waste. **(For open Book Examination, not for Semester Examination)**
5. Explain in detail about India's Underground Radioactive Waste Disposal site at Gogi in Karnataka? **(For open Book Examination, not for Semester Examination)**

19EE003 Fundamentals of Electric Vehicle Technology

3 1 0 3

Course Outcomes

1. Outline the dynamics of electric vehicles
2. Illustrate the layout of electric and hybrid electric vehicles
3. Identify suitable vehicle for the given application
4. Outline the speed torque characteristics of various drives
5. Summarize the various factors affecting the capacity of battery
6. Identify suitable drive and battery for the given application

COs – POs Mapping

COs	PO_2	PO_3	PO_{12}
1	2	2	3
2	2	2	3
3	3	3	3
4	2	2	3
5	2	2	3
6	3	3	3

3–Strongly linked | 2–Moderately linked | 1–Weakly linked

Unit I

Fundamentals of Vehicle

Vehicle Resistance, Types: Rolling Resistance, Grading resistance, Aerodynamic drag, Calculation of total force, Total Tractive Force, Wheel torque, Wheel Speed, Motor Torque, Motor Speed, Motor Power, Battery Power, Transmission: Differential, Clutch, gear box.

Battery design for two-wheeler

11+4 Hours

Unit II

Electric & Hybrid Electric Vehicles

Components, General Layout and Configurations of EV, EV Classification, Components of hybrid EV, General layout of HEV, Types of Hybrid EV.

Comparison with Internal combustion Engine: Benefits and Challenges

11+4 Hours

Unit III

Electric Vehicle Motors & Drives

DC Motor Drive-Construction, Principle, Closed loop control of dc drive, Induction Motor Drive-Construction, Principle, V/f control of Induction motor drive, BLDC motor drive- Construction, Principle, Speed & Torque Control of bldc drive.

PMSM drive

12+3 Hours

Unit IV

Cells and Batteries

Conversion of chemical energy to electrical energy, Classification of cells, factors affecting the capacity of the battery, Ampere-Hour & Watt- Hour efficiency, trickle charging, indications of full charged battery, Battery design Performance criteria for EV batteries, Vehicle propulsion factors, Power and energy requirements.

battery power calculation for an EV

11+4 Hours

Total: 45+15=60 Hours

Text Book(s):

1. Tom Denton , “Electric and Hybrid Vehicles”, CRC Press publications, second edition, 2020.
2. Chris Mi, Abul Masrur and David Wenzhong Gao, “Hybrid Electric Vehicles-Principles and Applications with Practical Perspectives”, A John Wiley & Sons, Ltd., Publication, 2nd Edition, 2017.
3. Iqbal Husain, “Electric and Hybrid Vehicles: Design Fundamentals”, CRC Press; 3rd edition, 2021.

4. Mehrdad Ehsani, Yimin Gao, Sebastien E. Gay and Ali Emadi "Modern Electric, Hybrid Electric, and Fuel Cell Vehicles', CRC Press, 2018.

Reference Book(s):

1. Amgad Elgowainy, "Electric, Hybrid, and Fuel Cell Vehicles", Springer publisher, New York, NY, 2021.
2. Amir Khajepour, Saber Fallah, Avesta Goodarzi, "Electric and hybrid vehicles technologies, modelling and control a mechatronic approach" Wiley Publications, first edition, 2014.
3. Per Enge, Nick Enge, Stephen Zoepf , "Electric Vehicle Engineering", McGraw-Hill Education, first edition, 2021.
4. Joeri Van Mierlo, "Plug in hybrid Electric vehicle(PHEV)", MDPI journal, special edition, 2019.

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Open Book Examination (%)
Remember	50	50	---
Understand	50	50	---
Apply	---	---	100
Analyze	---	---	---
Evaluate	---	---	---
Create	---	---	---
Total (%)	100	100	100

Remember

1. List the challenges faced by hybrid electric vehicle.
2. List any five differences between electric vehicle and hybrid electric vehicle.
3. List the components of a hybrid electric vehicle.
4. List the advantages and disadvantages of hybrid cars.
5. State and explain the dynamic equation of vehicle motion.

Understand

1. Explain the term rolling resistance and aerodynamic drag in vehicles and derive the expression for vehicle translational speed from fundamentals.
2. Obtain the mathematical modeling of electric vehicle to describe its performance.
3. Explain various electric drive train topologies.
4. Explain the design of a Hybrid Electric Vehicle (HEV) as a case study.
5. Explain the two-quadrant operation of chopper DC motor drive with suitable waveforms for electric vehicle

Apply

1. Rolling resistance 0.015
   Vehicle Mass 111 Kg
   Driver Mass 80 Kg
   Acceleration due to gravity 9.81 m/s^2
   Grade 0^o
   Area 0.875 m^2
   Air Desnsity 1.225 Kg/m^3
   Drag Coefficient 0.22
   Radius of Wheel 0.1524 m
   Gear ratio 7.4
   Transmission efficiency 0.85
   Motor efficiency 0.9
   GVM 191 Kg
   GVW 1873.1 Kg
   Motor controller efficiency 0.85
   Design the motor requirement for the above system.
   (For Open Book Examination and not for semester end examination)

2. Determine the torque vs speed and torque vs current characteristics for a separately excited dc motor with the following paprameters: 2.3hp, 220V, 600 rpm, R_a=1.39 ohms, L_a=0.00182 H, K_b=0.331 volt/rad/sec.The machine has rated field excitation and its armature is fed a constant voltage of 220 V dc.**(For Open Book Examination and not for semester end examination)**

19ME003 Industrial Engineering & Management

3 1 0 3

Course Outcome(s)

1. Design organization structure and implement management principles in real time business environment
2. Establish layouts for different types of industries, manufacturing, process and service sectors
3. Elaborate productivity and profitability by implementing work study and SQC
4. Select and maintain skilled and sufficient manpower for various business proposals
5. Find total production time and cost by using networking techniques
6. Enunciate a best method of making a product in the production process

COs- POs Mapping

COs	PO_1	PO_{11}
1	3	2
2	3	2
3	3	1
4	3	2
5	2	1
6	3	1

3 Strongly linked | 2 Moderately linked | 1 Weakly linked

Unit I

Evolution of Management Thought-Organizational Structures - Douglas McGregor‟s Theory X and Theory Y, Maslow‟s Hierarchy of Human Needs, Systems Approach to Management. Designing. Basic concepts related to Organization, Depart mentation and Decentralization, Types of mechanistic and organic structures of organization (Line organization, Line and staff organization, functional organization, Committee organization, matrix organization, Virtual Organization) and their merits, demerits and suitability. Cellular Organization and team structure

11+4 Hours

Unit II

Facilities location- Work study - Plant location, definition, factors affecting the plant location, comparison of rural and urban sites methods for selection of plant, Matrix approach, Plant Layout; definition, objectives, types of production, types of plant layout, various data analyzing forms, travel chart. Definition, objectives, method study; definition, objectives, steps involved, various types of associated charts. Work measurement- definition, time study, steps involved, equipment, different methods of performance rating, allowances, standard time calculation. Work Sampling, definition, steps involved. Standard time calculations and differences with time study

12+3 Hours

Unit III

Materials Management-Quality Control- Objectives, Inventory, functions, types, associated costs, inventory classification techniques, EOQ, ABC and VED analysis. Inspection and quality control, types of inspections, Statistical Quality Control; techniques, variables and attributes, assignable and non assignable causes, variable control charts, and R charts, attributes control charts, p charts and c charts. sampling plans. Introduction to TQM, Quality Circles, ISO 9000 series procedures

11+4 Hours

Unit IV

Introduction to PERT / CPM-Introduction to Human Resource Management - Project management, network modelling: PERT/CPM Time and cost estimations. Functions of HRM, Job Evaluation, different types of evaluation methods, Job description, Merit Rating, difference with job evaluation. Different methods of merit ratings, wage incentives.

11+4 Hours

Total: 45+15 Hours

Textbook(s)

1. O.P. Khanna, Industrial Engineering and Management, S Chand & Co Publications, 3rd Edition, 2013
2. Teslang Martand, Industrial Engineering and Production Management, S Chand & Co Publications, 1st Edition, 2002
3. Phillip E Hicks, Industrial Engineering and Management; a new perspective, TMH publications, 2nd Edition, 1994
4. H.T. Amrine, J. A. Ritchey and O.S. Hulley, Manufacturing Organization and Management, Prentice-Hall, 2nd Edition, 1966
5. P.C. Tripathi and P.N. Reddy, Principles of Management, TMH Publications, 4th Edition, 2012

Reference(s)

1. H. Koontz & H. Weihrich, Essentials of Management, Tata McGraw Hill, 8th Edition, 2010
2. Paneer Selvam, Production and Operations Management, PHI, 3rd Edition, 2012

Sample Question (s)

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Open Book Examination (%)
Remember	35	35	-
Understand	45	35	20
Apply	20	30	80
Analyze	-	-	-
Evaluate	-	-	-
Create	-	-	-
Total (%)	100	100	100

Remember

1. List the five objectives of work study
2. List any four merits and demerits of committee organization
3. Define Mc-Gregor‟s theory X and theory Y
4. List the three types of plant layout
5. List any four functions of HRM
6. List the three functions of material management?

Understand

1. Explain the factors effecting plant locations
2. Explain about purchase management
3. Write about Statistical Quality Control-techniques
4. Compare the Mc-Gregor‟s Theory X and Theory Y

Apply

1. Explain the attribute charts
2. Compare the PERT and CPM
3. Explain about stores management and stores records
4. What are the different types of evaluation methods and explain them?
5. Identify duties of purchase manager

19EC003 Interfacing and Programming with Arduino

3 1 0 3

Course Outcomes

1. Summarize the hardware and software of Arduino development board
2. Explain the working of I/O devices
3. Demonstrate the interfacing and programming of I/O devices with Arduino
4. Explain the working of different sensors
5. Demonstrate the interfacing and programming of sensors with Arduino
6. Summarize different applications of Arduino

COs – POs Mapping

COs	PO1	PO2
1	2	
2	2	
3	3	2
4	2	
5	3	2
6	2	

3–Strongly linked | 2–Moderately linked| 1–Weakly linked

Unit I

Arduino – Hardware and Software

Features of Arduino UNO Board, Arduino IDE Software, Serial Peripheral Interface (SPI) Communication Protocol, Inter-Integrated Circuit (I2C) Communication Protocol, Structure of Arduino Programming, Function,

Features of ATmega328, map function

11+4 Hours

Unit II

Interfacing and programming of IO Devices with Arduino

Interfacing and programming of Arduino with LED, Seven-segment display, LCD, push button, keypad, relay for high voltage devices, interfacing and programming of Arduino using PWM technique.

DC motor and Motor Driver IC L293D

11+3 Hours

Unit III

Interfacing and programming of Sensors with Arduino

Interfacing and programming of Arduino with temperature sensor, humidity and temperature sensor, light dependent register, touch sensor, smoke detector, ultrasonic sensor, soil moisture sensor.

Rain sensor and Bluetooth

12+4 Hours

Unit IV

Arduino based simple projects

Obstacle Detection and Warning System, Gas Leakage Detection, Burglar Detection, Weather Monitoring System, Plant Watering System

Mobile Phone Controlled Light

11+4 Hours

Total: 45+15 Hours

Textbook (s)

1. Yogesh Misra, Programming and Interfacing with Arduino, CRC Press, 1st Edition, 2021
2. James A. Langbridge, Arduino Sketches: Tools and Techniques for Programming Wizardry, Wiley, January 2015,

Reference (s)

1. Michael Margolis, "Arduino Cookbook", First Edition, March 2011, O'Reilly Media, Inc

Sample Question (S)

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Open Book Examination (%)
Remember	10	10	--
Understand	60	60	50
Apply	30	30	50
Analyze	--	--	--
Evaluate	--	--	--
Create	--	--	--
Total (%)	100	100	100

Remember

1. Recall the microcontroller used in Arduino UNO board.
2. List the pin numbers having PWM capabilities in Arduino UNO board.

Understand

1. Exemplify the SPI protocol for on board communication interface.
2. Exemplify the I2C protocol for on board communication interface.
3. Demonstrate the purpose of compiler and linker in firmware design.
4. Illustrate the different components of Arduino UNO board.
5. Illustrate the working of capacitive touch sensor.

Apply

1. Construct an interfacing diagram of LCD with Arduino board and develop the software to display a message from the 5^{th} row and 2^{nd} column of LCD.
2. Construct an interfacing circuit of 220 V ac operated bulb with Arduino board and develop the software to turn it on and off after a delay of 10 seconds.
3. Implement the hardware and software for automatic street light logic.

19CS003 Data Science for Engineering Applications

3 1 0 3

Course Outcomes:

At the end of the course, students will be able to:

1. Understand the fundamentals of data science.
2. Explain how data is collected, managed, and stored for data science.
3. Understand the data by applying various techniques.
4. Explore data visualization techniques.
5. Explore the technologies for data visualization
6. Investigate several applications in data science.

COs–POs Mapping

CO	PO2	PO3	PO4
1	1	2	2
2	3	2	2
3	3	1	2
4	3	2	2
5	3	2	2
6	2	2	2

3–Strongly linked | 2–Moderately linked | 1–Weakly linked

Unit-I:

Fundamentals of Data science

Introduction to core concepts and technologies: Introduction, Terminology, data science process, data science toolkit, Types of data, Example applications.

Data collection and management: Introduction, Sources of data, Data collection and APIs, Exploring and fixing data, Data storage and management, using multiple data sources.

11+4 Hours

Unit-II:

Data analysis

Basics of Data Analysis: Introduction, Terminology and concepts, Introduction to statistics, Central tendencies and distributions, Variance, Distribution properties and arithmetic, Samples/CLT.

Algorithms: Basic machine learning algorithms, Linear regression, SVM, Naive Bayes.

12+4 Hours

Unit-III:

Data visualization

Introduction, Types of data visualization, Data for visualization: Data types, Data encodings, Retinal variables, Mapping variables to encodings, Visual encodings.

11+4 Hours

Unit-IV: Data Science-Applications

Applications of Data Science, Technologies for visualisation, Bokeh (Python), Recent trends in various data collection and analysis techniques, various visualization techniques, application development methods of used in data science.

11+3 Hours

Total 45+15 = 60 Hours

Textbook:

1. Jeffrey S. Saltz, Jeffrey M. Stanton, "An Introduction to Data Science", SAGE Publications, 2018.
2. Anil K. Maheshwari, "Data Analytics Made Accessible", 2015 (Online)
3. Laura Igual ,Santi Seguí, "Introduction to Data Science A Python Approach to Concepts, Techniques and Applications", Springer Publications,2014

Reference(s)

1. Glenn J. Myatt, Wayne P. Johnson: Making Sense of Data I: A Practical Guide to Exploratory Data Analysis and Data Mining, 2nd Edition, Wiley,2014
2. Joseph F Hair, Barry J. Babin, Rolph E. Anderson, William C. Black: Multivariate Data Analysis Cengage, 2018

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Open Book Examination[1] (%)
Remember	40	30	--
Understand	40	40	--
Apply	20	30	80
Analyze	--		20
Evaluate	--	--	--
Create	--	--	--
Total (%)	100	100	100

SAMPLE QUESTION (S)

Remember

1. What is data science.
2. Define purpose of different data visualization aids
3. List any two steps involved in EDA.

Understand

1. Explain different data representation
2. Explain the role of various data grouping methods
3. Explain purpose of hypothesis testing in detail

Apply

1. Apply various visual aids to identify behavior of data
2. Make use of Multivariate Analysis methods for data analysis
3. Examine data with various distribution function

Open Book Exam Questions

Question 1:

Perform below analysis on a house price prediction dataset.

a. Univariate Analysis
    i. Analysis of a numerical feature
    ii. Analysis of a categorical feature
b. Bivariate Analysis
    i. Relationship of a numerical feature with another numerical feature
    ii. Relationship of a numerical feature with a categorical feature

Question 2:

Perform below analysis on weather prediction dataset.

a. Correlation Analysis
    i. Correlation Heat Map
    ii. Zoomed Heat Map
b. Investgation of missing values
    i. What's missing? to what extent?

Visualizing missing values in a dataframe

19CH003 Industrial Ecology for Sustainable Development

3 1 0 3

Course Outcomes

1. Explain the basic concepts of industrial ecology and sustainability
2. Compare between biological and industrial organisms
3. Analyze energy and material flows in natural and technical systems at different scales
4. Utilize the concept of life cycle assessment before designing a product or process
5. Utilize the concept of industrial symbiosis to develop sustainable technical collaboration
6. Evaluate the availability of renewable and fossil resources for industrial processes

CO-PO Mapping

CO	PO_2	PO_6	PO_7
1	3	3	3
2	3	3	3
3	3	3	3
4	3	3	3
5	3	3	3
6	3	3	3

3–Strongly linked | 2–Moderately linked | 1–Weakly linked

Unit I

Sustainability as Applied to Industrial Ecology

The tragedy of the commons–Technological evolution and the master (IPAT) equation–Industrial ecology activities and sustainability–Linking industrial ecology activities to sustainability–Greening of engineering Biological and industrial organisms and ecosystems–Engineering by biological and industrial organisms–Metabolisms of biological and industrial organisms–Risk assessment and management–Social dimensions of industrial ecology

Limits to Growth

11+4 Hours

Unit II

Sustainable Engineering & Life Cycle Assessment

Green chemistry and engineering–Process design and life cycle–Green technology and sustainability–Design for Environment and Sustainability

Concept of life cycle assessment–The LCA framework–Goal setting and scope determination–Life cycle of industrial products–Impact and interpretation–Limitations of LCA

Life cycle assessment of processes

11+4 Hours

Unit III

Industrial Ecosystems

Ecosystems and food chains–Food web–Industrial symbiosis–Designing and developing symbiotic industrial ecosystem–Eco-industrial Park - Material flow analysis, utility of material flow analysis

Eco-industrial Park initiatives around the world

11+4 Hours

Unit IV

Energy and Industrial Ecology

Energy and organisms–Energy and the product life cycle–Energy and mineral resources–Energy and industrial ecology

Industrial ecology and sustainable engineering in developing economies–Industrial ecology and sustainability in the corporation

Energy efficiency through industrial ecology

12+3 Hours

Total: 45+15 Hours

Text Book (s)

1. T. E. Graedel, B. R. Allenby, Industrial Ecology and Sustainable Engineering, 1st Ed., Pearson, USA. 2010

Reference Book (s)

1. R. U. Ayres, L. W. Ayres, A Handbook of Industrial Ecology, Edward Elgar Publishing, 2002

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Assignment test (%)
Remember	20	20	10
Understand	40	40	40
Apply	40	40	50
Analyze	--	--	
Evaluate	--	--	-
Create	--	--	--
Total (%)	100	100	100

Sample Question (s)

Remember

1. State any two drivers for and barriers to industrial ecosystems.
2. State the order of precedence for approaches to packing in decreasing order of preference.

Understand

1. What do you mean by 3-2 heuristic in industrial symbiosis?
2. What do you mean by material flow analysis?
3. Present any two thoughts/desirables on development in lesser developed countries.

Apply

1. What are the three types of consumption pattern? What is sustainable consumption and how does IPAT equation help in achieving sustainable consumption
2. Discuss about rapidly developing country and slowly developing country dynamics and perspectives?
3. Discuss about the alternative corporate approaches including defensive, cost-oriented and proactive approaches to environment and sustainability?
4. For a metal processing system using only virgin raw material with E_p = 31 GJ/t, E_f = 5GJ/t, E_m = 5GJ/t and β = 0.1, compute the energy consumed per kg of output material (φ). E_p, E_f, and E_m are the energy consumed during production, fabrication, and manufacture and, β is the fraction of throughput that is reused as prompt scrap.
5. Discuss the concept of circular economy. How was it applied to the entire economy in China?

19IT003 Fundamentals of Mobile Computing

3 1 0 3

Course Outcomes

1. Interpret the GSM architecture and its services.
2. Understand the various wireless applications and study technical feasibility of various mobile applications.
3. Utilize the mobile network layer protocols and its functionalities.
4. Explain any existing or new models of mobile environments for 4G networks
5. Understand platform, protocols and related concepts of Ad hoc and Enterprise wireless networks
6. Understand IP and TCP layers of Mobile Communications

CO – PO Mapping

COs	PO_1	PO_7
1	3	2
2	3	2
3	3	2
4	3	2
5	3	1
6	3	1

3–Strongly linked | 2–Moderately linked | 1–Weakly linked

Syllabus

Unit I

Introduction: Mobile Communications and Mobile Computing – Paradigm, Promises/Novel Applications and Impediments and Architecture; Mobile and Handheld Devices, Limitations of Mobile and Handheld Devices. Global System for Mobile Communication (GSM): Services, System Architecture, Radio Interfaces, Protocols, Localization, Calling, Handover, New Data Services, GPRS Architecture, GPRS Network Nodes.
Evolution of Mobile computing

12+4 Hours

Unit II

Medium Access Control (MAC) : Motivation for a specialized MAC (Hidden and exposed terminals, Near and far terminals), Wireless LAN/(IEEE 802.11) architecture, key IEEE802.11 a/b/c/d/e/g/i/n/T/ac/ standards. Wireless Application Protocol (WAP): The Mobile Internet standard, WAP Gateway and Protocols, wireless markup Languages (WML). Wireless Local Loop (WLL): Introduction to WLL Architecture.
wireless Local Loop Technologies

11+4 Hours

Unit III

Mobile Network Layer : IP and Mobile IP Network Layers, Packet Delivery and Handover Management, Location Management, Registration, Tunneling and Encapsulation,
Mobile Transport Layer : Conventional TCP/IP Protocols, Indirect TCP, Snooping TCP, Mobile TCP. Third Generation (4G) Mobile Services: Comparison of different generations, Introduction to International Mobile Telecommunications 2000 (IMT 2000) vision.
Wideband Code Division Multiple Access, Time out freezing

11+4 Hours

Unit IV

Mobile Ad hoc Networks (MANETs) : Introduction, Applications & Challenges of a MANET, Routing, Classification of Routing Algorithms, Algorithms such as DSR, AODV, DSDV, etc. , Mobile Agents, Service

Discovery ,case study using NS2 –traffic analysis using CBR and VBR Wireless Enterprise Networks: Introduction to Virtual Networks, Blue tooth technology.

Blue tooth Protocols.

11+3 Hours

Total: 45+15 Hours

Textbook (s)

1. Jochen Schiller, "Mobile Communications", Addison-Wesley, Second Edition, 2009.
2. Raj Kamal, "Mobile Computing", Oxford University Press, 2007, ISBN: 0195686772

Reference (s)

1. Asoke K Talukder, Hasan Ahmed, Roopa R Yavagal, "Mobile Computing, Technology Applications and Service Creation" Second Edition, 2010 McGraw Hill.
2. Martin Sauter, "From GSM to LTE-Advanced: An Introduction to Mobile Networks and Mobile Broadband," Second Edition, 2014 Wiley.

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Open Book Exam (%)
Remember	30	30	-
Understand	70	70	40
Apply	-	-	60
Analyze	-	-	-
Evaluate	-	-	-
Create	-	-	--
Total (%)	100	100	100

Sample Question (S)

Remember

1. List any four Application of Mobile Computing
2. Define Mobile Computing

Understand

1. Explain Mobile Ad hoc Networks
2. Explain the role Blue tooth technology in Mobile Computing
3. Illustrate Classification of Routing Algorithms

Apply

1. Discuss about Mobile transport Layer
2. Illustrate Blue tooth technology
3. Describe classification of Routing algorithms
4. Illustrate challenges of MANET

Open Book Exam Questions

1. Why "MAC protocol designed for infrastructure based wireless network may not work satisfactory in infrastructure less environment " – justify?
2. why the traditional IP cannot be used in a mobile network. What are the main differences between the traditional IP and the mobile IP? How does mobile IP support mobile hubs?

19BS004 Advanced Materials for Renewable Energy

3 1 0 3

Course Outcomes

1. Understand the conventional and renewable energy sources.
2. Explain hydrogen production, storage and use as fuel.
3. Illustrate the concept and types of fuel cells.
4. Understand the various solar cells and their applications
5. Demonstrate energy storage through batteries and their technologies.
6. Understand the concept of supercapacitor and their characteristics.

COs–POs Mapping

COs	PO1	PO7
1	2	3
2	2	3
3	2	3
4	2	3
5	2	3
6	1	3

3–Strongly linked | 2–Moderately linked | 1–Weakly linked

Unit I

Renewable and Nonrenewable Energy sources

Introduction - Conventional fossil fuels- Coal and natural gas- Renewable energy sources-Photovoltaics- Hydrogen production from biomass, geothermal, solar and wind energy - Fuel cells-principle and working.
Advantages of renewable energy technologies.

10+3 Hours

Unit II

Fuel Cells & Hydrogen Production and Storage

Materials for hydrogen production - storage, utilization & dispensing - Electrochemical: Electrolysis, Photo electro chemical. Biological: Photo Biological, Anaerobic Digestion Fermentative Micro- organisms. Physical and chemical properties - 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.

13+4 Hours

Unit III

Photovoltaics

Solar Spectrum, Solar constant–Materials for Renewable energy conversion- Photovoltaics - Silicon (Si) solar cells, Crystalline/ Semi crystalline/ Amorphous Si solar cells- Thin film solar cells. Photochemical cells, photocatalytic, Mechanism of photovoltaics- Factors affecting electron transfer. Organic solar cells-polymer solar cells- perovskite solar cells.
Hybrid solar cells

11+4 Hours

Unit-IV

Energy Storage- Batteries and super capacitors

Batteries -Primary and Secondary cells-Conventional battery technologies- merits and demerits- Recent battery technologies- Lithium-ion- Sodium ion- Metal-air batteries - Design, Fabrication, operation and evaluation-Super capacitors- Fundamentals of Electrochemical Super capacitors, Electrode and electrolyte interfaces and their capacitances, Charge-Discharge characteristics, Energy/power density.
Applications of batteries and super capacitors

11+4 Hours

Total: 45+15 Hours

Text Book (S)

1. B.K. Hodge, "Alternate Energy Systems and Applications", John Wiley & sons, Inc., 2010.
2. C. Brabec, "Organic Photovoltaics", Wiley-VCH, 2008.
3. Norman S. Allen (Ed.), "Photochemistry and Photophysics of Polymeric Materials", 2010.
4. V. Hacker, S. Mitsushima(Eds.), "Fuel Cells and Hydrogen: From Fundamentals toApplied Research", Elsevier, 2018.
5. C. Daniel and Jurgen O. Besenhard, "Handbook of Battery Materials", Wiley-VCH Verlag,2011.
6. A. Yu, V. Chabot, and J. Zhang, "Electrochemical Super capacitors for Energy Storage and delivery" 1st Ed., CRC Press, Taylor & Francis group, 2012.
7. L. Liu and S.Bashir, "Advanced Nanomaterials and their Applications in RenewableEnergy", Elsevier Science, 2015.

Reference (S)

1. X. Moya David and Muñoz-Rojas (Ed.), "Materials for Sustainable Energy Applications Conversion, Storage, Transmission, and Consumption",Pan Stanford Publishing Pvt. Ltd. 2016.
2. Alan J. Heeger, Niyazi Serdar Sariciftci and Ebinazar B. Namdas, "Semiconducting and Metallic Polymers", Oxford Univ Press 2010.
3. W. Streicher and M. Kaltschmitt (Ed.) "Renewable energy. Technology, economics and environment", Springer, 2007.
4. N. Armaroli, V. Balzani and N. Serpone, "Powering Planet Earth – Energy Solutions for the Future", WILEY- VCH, 2012.
5. A.J. Bard, L.R. Faulkner, "Electrochemical Methods, Fundamentals and Application". Wiley, 2001.
6. K.E. Aifantis, S.A. Hackney, and R. V. Kumar (Ed.) "High Energy Density Lithium Batteries Materials, Engineering, Applications", WILEY-VCH Verlag GmbH & Co. KGaA, 2010.
7. Delivery Fundamentals and Applications, Taylor & Francis Group, 2013.
8. F. Beguin and E. Frackowiak, "Super capacitors- Materials, Systems, and Applications", Wiley- VCH Verlag GmbH & Co. 2013.

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Open Book Exam (%)
Remember	25	25	10
Understand	45	45	10
Apply	30	30	80
Analyze	--	-	-
Evaluate	--	-	-
Create	--	-	-
Total (%)	100	100	100

Sample question (s)

Remember

1. What is renewable energy?
2. List any two Conventional fossil fuels.
3. State primary and secondary batteries.

Understand

1. Explain the concept of fuel cell.
2. Differentiate organic and polymer solar cells.
3. Describe the processing of power generation by fuel cells.

Apply

1. Identify the principle behind wind energy.
2. Select various factors affecting electrontransfer in solar cells.
3. Choose materials for Photovoltaics.

Open Book Exam

1. You are given the job of fabricating a super capacitor.
   (a) Which process/ process parameter you choose for material synthesis? What factors do you consider while choosing the process?
   (b) Among the cost, raw material availability, morphology, material category (crystalline/ glass/ composite), which factor do you think should be given priority? Justify your answer.
   (c) *Change in material morphology leads to change in the super capacitance behaviour*. State True or False and Justify your answer.

19BS005 Applied Linear Algebra for Engineers

3 1 0 3

Course Outcomes

1. Understand about Eigen values and Eigen vectors of Complex matrices
2. Compute solution of system of non-homogenous equations
3. Learn the basic notion of Vector Spaces and understand related properties
4. Study about Basis and Dimensions of vector spaces
5. Understand the properties of Linear Transformations
6. Apply the concept of Vector Spaces using Linear Transformations

COs – POs Mapping

COs	PO_1	PO_{12}
1	3	1
2	3	1
3	3	1
4	3	1
5	3	1
6	3	1

3-Strongly linked | 2-Moderately linked | 1-Weakly linked

Unit I

Complex Matrices & System of Non-Homogenous Equations

Complex Matrices - Introduction, Hermitian, Skew-Hermitian and Unitary Matrices, Properties of Hermitian, Skew-Hermitian and Unitary Matrices, Eigen values and Eigen Vectors of Complex Matrices, Power method.
System of non-homogenous equations - Cholesky's Method, Crout's Method
Invertible Matrices and their some applications in Cryptography

12+3 Hours

Unit II

Vector Spaces

Vector Spaces - Introduction, Properties of Vector Spaces, Subspaces, Algebra of Subspaces, Linear combination of vectors, Linear Span, Linear Independence and Dependence of vectors (All theorems without Proof)
Study of Linear Independence and Dependence using Wronskian

11+4 Hours

Unit III

Finite dimensional Vector Spaces

Finite Dimensional Vector Spaces - Basis of Vector Space, Basis Extension Theorem, Dimension of a Vector Space, Dimension of a Subspace, Quotient Spaces and Dimension of Quotient space (All theorems without Proof)
Study about Row and column spaces

11+4 Hours

Unit IV

Linear transformations and Applications

Linear transformations - Linear Operators, Properties of Linear Transformations, Algebra of Linear Operators, Range Space of Linear Transformation, Null space of Linear Transformation, Rank and Nullity of Linear Transformations, Rank-Nullity Theorem (All theorems without Proof)
Application of Linear Transformation to Animation on a Computer screen

11+4 Hours
Total:45+15 Hours

Textbook (s)

1. J.N Sharma and A. R Vasista, "Linear Algebra", Krishna's Educational Publishers, Meerut, 2021.
2. B. S. Grewal, "Higher Engineering Mathematics", 42nd Ed., Khanna Publishers, New Delhi, 2014.
3. A Ramkrishna Prasad, "Kreyszig's,Mathematical Methods",Wiley India,2009

Reference (s)

1. Shanti Narayana ,A Text Book of Matrices, , S. Chand Publishing,2020.
2. Jin Ho Kwak and Sungpyo Hong,"Linear Algebra", 2nd Ed., Springer, 2004.
3. T K V Iyengar, B Krishna Gandhi, S Ranganatham and M.V.S.S.N Prasad, "Mathematical Methods", S. Chand,2016.

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Open Book Exam (%)
Remember	20	20	-
Understand	50	50	30
Apply	30	30	70
Analyze	-	-	-
Evaluate	-	-	-
Create	-	-	-
Total (%)	100	100	100

Sample question (s)

Remember

1. Define Skew Hermitian matrix.
2. Define Vector Space.

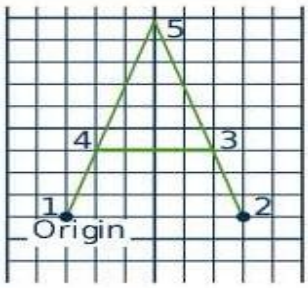
Understand

1. Show that the set S={(-1,0,1,0),(1,-3,2,-4),(1,3,-4,-2),(2,2,-4,0)} in R^4 is linearly dependent.
2. Show that $T: R^3 \to R^3$ is defined by $T(x, y, z) = (x - y, 0, y + z)$ is a linear transformation.

Apply

1. Using Power Method, determine the largest Eigen value and the corresponding Eigen vector for the matrix $A = \begin{matrix} 2 & -1 & 0 \\ -1 & 2 & -1 \\ 0 & -1 & 2 \end{matrix}$.
2. Find rank of the transformation $T: R^2 \to R^3$ defined by $T(x, y) = (x + y, x - y, y)$ using Rank-Nullity Theorem.

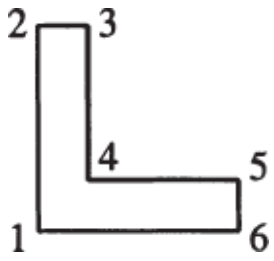
Open book Examination question(s)



1. Model the matrix for the figure given below.
   i. Draw the image corresponding to the matrix obtained by multiplying $\begin{bmatrix} 1 & 0.2 \\ 0 & 1 \end{bmatrix}$ with obtained matrix in (i)
   ii. Sketch the image and write the corresponding matrix by rotating the following figure through the angle $\frac{\pi}{6}$ about the point $\begin{bmatrix} 4 \\ 5 \end{bmatrix}$.

2. Consider the letter L as shown in the figure below. L can be represented by a matrix with coordinates of the vertices as 1 2 3 4 5 6

$$\begin{bmatrix} 0.0 & 0.0 & 0.5 & 0.5 & 2.0 & 2.0 \\ 0.0 & 2.0 & 2.0 & 0.5 & 0.5 & 0.0 \end{bmatrix} = A$$



Where first row values represents X-coordinates and second row values represents Y-coordinates.

   i. Model the matrix obtained by multiplying $B = \begin{bmatrix} 1 & 0.25 \\ 0 & 1 \end{bmatrix}$ with A.
   ii. Sketch the image of (i).

iii. What kind of figure can you have, if $B^T A$ replaced with BA.

19CE019 Green Buildings

0 0 0 3

Course Outcomes

1. Apply the knowledge in development of green field infrastructure in relation to sustainable environment.
2. Explain Green Building specifications and various eco-friendly materials
3. Choose and size building components, as well as energy and environmental systems suitable for different categories of buildings to achieve the smallest feasible life-time environmental impact.
4. Utilize a variety of tools and methodologies suitable for evaluating the resource consumption and overall environmental performance of buildings in different stages of their life cycles
5. Summarize importance of solar energy in green buildings.
6. Demonstrate the passive energy system and components of building fabrics and materials

COs–POs Mapping 33

COs	PO1	PO7	PO12
1	3	3	2
2	2	3	1
3	3	3	1
4	3	3	1
5	3	3	2
6	3	3	2

3–Strongly linked | 2–Moderately linked | 1– Weakly linked

Unit I

Green Buildings

Definition of Green Buildings, typical features of green buildings, benefits of Green Buildings, Green building Principles, Sustainable site selection and planning of buildings to maximize comfort, day lighting, ventilation, planning for storm water drainage

Smart Buildings, technologies

11+4 Hours

Unit II

Environmentally Friendly Building Materials and Technologies

Natural Materials like bamboo, timber, rammed earth, stabilized mud blocks, hollow blocks, lime & lime pozzolana cements, materials from agro and industrial waste, ferro-cement, alternative roofing systems, various paints reducing the heat gain of the building, etc.

Ferro Concrete, bamboo as a construction material

11+4 Hours

Unit III

Energy and Resource Conservation and Use of Renewable Energy Resources

Need for energy conservation, various forms of energy used in buildings, embodied energy of materials, energy used in transportation and construction processes- water conservation systems in buildings- water harvesting in buildings – waste to energy management in residential complexes or gated communities. Wind and Solar Energy Harvesting.

Case studies of fully solar energy-based buildings in India

12+3 Hours

Unit IV

Building Resources and Green Building Rating Systems

Passive energy system design, Building envelope, orientation and components of building fabric and shading, Construction of curtain walls, Sourcing and recycling of building materials. Introduction to Leadership in Energy and Environment Design (LEED), Green Rating systems for Integrated Habitat Assessment – Modular wastewater treatment systems for built environment.

Building management systems, LEED certification

11+4 Hours

Total: 45+15 Hours

Textbook (s)

1. K.S.Jagadish, B. U. Venkataramareddy, K. S. Nanjundarao, Alternative Building Materials and Technologies, 2nd Ed., New Age International, 2007
2. Osman Attmann, Green Architecture Advanced Technologies and Materials, McGraw Hill, 2010

Reference (s)

1. Kibert, C. J, Sustainable Construction:Green Building Design and Delivery, 3 rd Ed., John Wiley & Sons, Inc., 2012
2. G. D. Rai, Non-Conventional Energy Resources,6th Ed., Khanna Publishers.1988
3. Greening Building – Green Congress, US. (Web).
4. Sustainable Building Design Manual. Vol 1 and 2, Teri, New Delhi, 2004.

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Open Book Exam (%)
Remember	50	50	-
Understand	50	50	100
Apply	-	-	-
Analyse	-	-	-
Evaluate	-	-	-
Create	-	-	-
Total (%)	100	100	100

Sample Question (s)

Remember

1. What are the aims and objectives of green building development?
2. What is a LEED Building?
3. What are the principles of green buildings?
4. Discuss the various forms of energy and energy scenario in India **(For Open Book Examination, not for Semester Examination)**

Understand

1. Explain various rating systems for the assessment of sustainability.
2. Explain the necessity of understanding basic concepts of green buildings and intelligent buildings.
3. Explain about the various rating systems for the assessment of sustainability **(For Open Book Examination, not for Semester Examination).**

19EE017 Sustainable Energy

0 0 0 3

Course Outcomes

1. Understand various terms related to sustainability
2. Understand the estimation and valuation of different energy sources
3. Identify the key issues and lessons learned for sustainable development
4. Outline the technical performance of sustainability
5. Summarize the interaction of energy systems with the environment
6. Identify the environmental benefits and implications of sustainable energy

COs – POs Mapping

COs	PO_1	PO_2	PO_{12}
1	2	1	1
2	3	2	2
3	2	1	2
4	2	1	1
5	3	2	2
6	1	2	2

3–Strongly linked | 2–Moderately linked| 1–Weakly linked

Unit-I

Fundamentals of Sustainable Energy

Sustainable Energy Systems: Issues for the 21st century, Critical challenges for a sustainable energy future, definitions, indicators, Key energy stakeholders, Energy: conservation, efficiency.
investments and divestments.

11+4 Hours

Unit-II

Estimations and Evaluation of Energy resources

Units of measurement: Energy and Power, comparison of different forms of energy, the energy life cycle, estimation and valuation of fossil mineral fuels, estimation and valuation of Nuclear Fuel Resources, Estimation and Valuation of Renewable Energy Resources.
Lessons for Sustainable Development

11+4 Hours

Unit III

Technical Performance: Efficiency and Production Rates

The Relation of Technical Performance to Sustainability, An Introduction to Methods of Thermodynamic Analysis, The Importance of Rate Processes in Energy Conversion, Chemical Rate Processes, The Physical Transport of Heat, Energy Requirements for Gas Separation Processes, Use and Abuse of Time Scales,
Energy Resources and Energy Conversion: Fertile Common Ground.

12+4 Hours

Unit IV

Local, Regional, and Global Environmental Effects of Energy

How Energy Systems Interact with the Environment, Adverse Environmental Effects over Local and Regional Length Scales, Global Climate Change: Environmental Consequences over Planetary Length Scales, Attribution of Environmental Damage to Energy Utilization, Methods of Environmental Protection, Environmental Benefits of Energy,
Implications for Sustainable Energy.

11+3 Hours

Total: 45+15 Hours

Text Book(s):

1. Jefferson W. Tester, Elisabeth M. Drake, Michael J. Driscoll, Michael W. Golay, and William A. Peters "Sustainable Energy: Choosing among options" Second edition, The MIT Press Cambridge, Massachusetts London, England, 2012.

2. Frank kreith, Susan krumdieck, "Principles of sustainable energy systems", second edition, CRC Press, Taylor and Francis group, 2008.

Reference Book(s):

1. Ibrahim Dincer and Marc A. Rosen (Eds.), "Exergy. Energy, Environment and Sustainable Development" second edition, Elsevier sciences, 2013
2. Course readings and other reference are available on Canvas: https://umich.instructure.com/
3. US Department of Energy, Energy Information Administration: http://www.eia.doe.gov/
4. International Energy Agency: http://iea.org/
5. US DOE Office of Energy Efficiency and Renewable Energy (EERE) http://energy.gov/eere/office-energy-efficiency-renewable-energy
6. Renewable Energy World News and Network: http://www.renewableenergyworld.com/
7. OpenEnergyInfo Gateway to world energy information/ data http://en.openei.org/wiki/Main_Page

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Open Book Examination (%)
Remember	25	15	--
Understand	50	35	--
Apply	25	50	100
Analyze	--	--	--
Evaluate	--	--	--
Create	--	--	--
Total (%)	100	100	100

Sample Question (s)

Remember

1. What are the critical challenges of future sustainable energy?
2. What is energy conservation?

Understand

1. Explain how estimation is done for nuclear fuel resources?
2. Demonstrate the rate process in energy conservation?

Apply

1. Taking the recent World Energy Council and United Nations resource-base figures for the total amount of fossil energy in the ground worldwide as 356,000 quads, how long will it take to exhaust our fossil resources, assuming that we can recover one-half of the resource base and that usage grows at 3% per year? The world currently consumes about 400 quads of primary energy per year, of which 85% is from fossil sources. (Hint: you will need to account for the compounding, exponential growth effect of the 3% per year increase in consumption.)Identify the key factors from the case study of the city Paris- a city of modernity?
2. How much power in MW are you delivering to your car when you fill it up at a self-service gas station?
3. A novel heat engine is being considered for producing work from the thermal energy contained in the wastewater discharge from a large food-processing plant. On an average day, 35 ° C wastewater leaves the plant and is discharged into the ocean at 1,000 gallons per minute. If the average annual ocean temperature is 10 ° C at that location, what is the maximum power that could be produced by this heat engine? What would be the thermal cycle efficiency of your maximum power engine? You can assume that the heat capacity of water at constant pressure is constant at 4,200 J/kg K. **(For Open Book Examination and not for semester end examination)**
4. Estimate the rate of heat loss due to radiation from a covered pot of water at 95 ° C. How does this compare with the 60 W that is lost due only to convection and conduction losses? What amount of energy input would be needed to maintain the water at its boiling point for 30 minutes? The polished stainless steel pot is cylindrical, 20 cm in diameter and 14 cm high, with a tight-fitting flat cover. The air temperature in the kitchen is about 25 ° C. State any assumptions you make in deriving your estimates. **(For Open Book Examination and not for semester end examination)**

19ME019 Total Quality Management

0 0 0 3

Course Outcome(s)

1. Demonstrate the demining philosophy as a frame work for TQM
2. Identify customer needs to enhance the quality management
3. Appraise the employee's involvement critically for effective team work requirements
4. Describe several techniques of quality management tools
5. Apply benchmarking and FMEA processes for effective quality management.
6. Apply ISO standards for design and development of products and services.

COs-POs Mapping

COs	PO_1	PO_{11}
1	2	3
2	1	3
3	2	1
4	3	2
5	2	1
6	3	1

3 – Strongly linked | 2 – Moderately linked | 1 – Weakly linked

Unit I

Introduction- Definition and principles of quality Evolution of Quality Quality Planning Quality policies and objectives. Dimensions of product and service quality. Contributions of Demeing, Juran and Crosby Customer focus. Customer stratification, Customers complaints and Customer retention.

Basic concepts of TQM, Barriers to TQM, customer feedback.

Unit II

TQM Principles-Employee's- Motivation, Empowerment, Team & Team work, Recognition and Reward, Performance appraisal Benefitsof employee's involvement, performance measure, balance score card, Continuous Process Improvement, PDCA cycle, Kaizen 5s, Reengineering Supplier relationship Partnering, Supplier selection, Supplier rating.

Unit III

TQM Techniques- New management tools, New and old 7 QC tools, an affinity diagram, tree diagram, matrix diagram, Six sigma methodology, infrastructure, implementation, Bench marking, process, Taguchi philosophy of quality control.

TPM concepts, improvement needs

Unit IV

Quality System- Need for ISO 9000 system, Advantages, Clauses of ISO 9000, Implementation of ISO 9000, Quality costs, Quality auditing, Case studies of TQM implementation in manufacturing and service sectors including IT industry.

Need for quality system, Principles, Revision standards.

Total: 60 Hours

Textbook(s)

1. Dale H. Besterfiled, Total Quality Management, Pearson, 3rd Revised Edition, 2011
2. Subbaraj Ramasamy, Total Quality Management, Tata McGraw Hills, New Delhi, 4th Edition, 2012

Reference(s)

1. James R. Evans and William M. Lindsay, The Management and Control of Quality, 8th Edition, Fist Indian Edition, Cengage Learning, 2012
2. K. C. Jain and A. K. Chitale, Quality Assurance and Total Quality Management, Khanna Publication, 3rd Edition, 2003
3. Suganthi, L and Anand Samuel, Total Quality Management, Prentice Hall (India) Pvt. Ltd., 3rd Edition, 2006
4. Douglas C. Montgomery, Design and Analysis of Experiments Minitab manual, JWS, 7th Edition, 2010

Web Reference(s)

1. https://archive.nptel.ac.in/courses/110/101/110101010/
2. https://archive.nptel.ac.in/courses/112/107/112107259/

Video Reference(s)

1. https://archive.nptel.ac.in/courses/112/106/112106249/
2. https://archive.nptel.ac.in/courses/112/106/112106253/

Sample Question(s)

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Open Book Examination (%)
Remember	25	35	-
Understand	35	25	20
Apply	40	40	80
Analyze	-	-	-
Evaluate	-	-	-
Create	-	-	-
Total (%)	100	100	100

Remember

1. Examine the definitions of quality by the quality gurus
2. List out the basic concepts of TQM
3. Define quality policies and its objectives
4. Explain the five distinct dimensions of quality
5. Explain the purpose of different quality statements

Understand

1. Explain concepts of continuous improvement
2. Briefly explain the eight pillars of TPM
3. Contrast and compare Six Sigma with total quality management
4. Explain mutually beneficial supplier relationships

Apply

1. Discuss in detail about the various tasks of employee involvement.
2. Enumerate the seven magnificent quality tools which form a significant part of the six-sigma tool kit.
3. Discuss the eight quality principles of management on which ISO9000 is based.

19EC011 Communication Technologies

0 0 0 3

Course Outcomes

1. Illustrate the importance of analog communications.
2. Interpret the concept of satellite communication.
3. Asses the operations of RADAR
4. Explain various Fibre Optic phenomena
5. Summarise the characteristics of fibre optic elements.
6. Demonstrate the concept of cellular system and wireless networks.

COs – POs Mapping

COs	PO1	PO2
1	2	
2	2	
3	3	2
4	2	
5	2	
6	3	2

3–Strongly linked | 2–Moderately linked| 1–Weakly linked

Unit I

Principles of Communication

Structure of Communication, Simplex, half duplex and full duplex communication, Serial and Parallel communication, Need of Modulation, Amplitude modulation, Frequency modulation, Pulse code modulation, Time division multiplexing, Frequency division multiplexing.

Frequency spectrum, Phase modulation **11+4 Hours**

Unit II

Satellite Communication & Radar

History of Satellite communication, Basics of Satellites, Types of Satellites, Launch Vehicles and Orbits: Introduction to launching vehicles, Important Orbits, Basics of Global Positioning System (GPS) - Applications of GPS, Introduction to Radar, Applications of Radar.

Active and passive satellites **12+3 Hours**

Unit III

Fibre Optic Communication

Optical fibre – Total Internal Reflection (TIR), Numerical Aperture(NA), Modes and dispersion, losses in fibres, fibre optic cables – Splices, connectors, optical couplers , switches & relays, optical emitters: LED & LASER diode, optical detector - PIN diode

Wavelength division multiplexing (WDM), photo transistor **12+4 Hours**

Unit IV

Mobile Communication

Evolution of mobile radio communication, Cellular concept and frequency reuse, wireless Personal Area Networks: Bluetooth and ZigBee, Wireless Local Area Networks: IEEE 802.11, network architecture, medium access methods and WLAN standards, Wireless Metropolitan Area Networks - WiMAX

Line of Sight, Multipath **10+4 Hours**

Total: 45+15 Hours

Text Book(s):

1. B. P. Lathi, " Modern Digital And Analog Communication Systems: ", Oxford University Press, 2017.
2. Frenzel, " Communication Electronics", TMH, 2017.
3. Trimothy Pratt, Charles W. Bostian, Jeremy E. Allnutt,"Satellite Communications", John Wiley and Sons, 2002.

Reference Book(s)

1. Gottapu Sasibhushana Rao, " Mobile and Cellular Communications". Pearson Education, 2013
2. Gerd Keiser "Optical Fiber Communication", TMH, 2017.
3. Andreas F.Molisch "Wireless Communications", Wiley, Second Edition, 2014.

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Open Book Examination (%)
Remember	25	15	--
Understand	75	50	50
Apply	--	35	50
Analyze	--	--	--
Evaluate	--	--	--
Create	--	--	--
Total (%)	100	100	100

Remember

1. Define half duplex and full duplex communication.
2. Reproduce the full form of RADAR
3. Reproduce the full form of LED

Understand

1. Explain the basic elements of satellite communication system.
2. Explain the working of PIN diode.
3. Explain the concept of frequency reuse

Apply

1. Demonstrate the use of Bluetooth in communication.
2. Demonstrate the applications of RADAR
3. Assess the difference between TDM and FDM.

19CS020 Applications of Artificial Intelligence

0 0 0 3

Course Outcomes

1. Illustrate the scope of Artificial Intelligence (AI) in gaming and expert systems.
2. Demonstrate various applications of AI related to perception and biometrics.
3. Summarize and learn different case studies in classification and recognition systems.
4. Describe and apply natural language processing techniques for designing AI Bots,
5. Illustrate the role of AI in robotics.
6. Demonstrate the state of AI in solving human labor problems for social equity.

CO-PO Mapping:

COs	PO2	PO3	PO6	PO7
1	3	3	3	1
2	3	3	3	1
3	3	3	2	1
4	2	2	2	2
5	2	1	1	2
6	1	1	1	3

3–Strongly linked | 2–Moderately linked | 1–Weakly linked

Unit -I:

AI for Everyone, Gaming and Expert Systems

AI for Everyone- What is AI? AI Explosion, AI at work, AI at Society, Applications of AI**. Gaming –** Games as search problems**-** Mini Max Search, Alpha Beta Cutt-Offs, State of the Art Games- Chess & Checkers Problem. **Expert Systems-** Representing and using domain knowledge, Expert System Shells, Explanation and Knowledge Acquisition. **Case Study:** MYCIN expert system using AI to identify bacteria causing Infections.
AI in fashion, Ethics and Laws for Holding AI.

10+4 Hours

Unit -II:

Perceptions and Biometrics

Perceptions-Image formation, Image Processing Operations, Object Recognition by appearance, Reconstructing the 3D world, Object recognition from structural information. Using Vision for manipulation and navigation. **Biometrics-** Understanding the Biometric fingerprints, facials, voice, iris, palm, and finger vein patterns Identifies Challenges in Biometric Systems. **Case Study I**: Text Classification System **Case Study II:** Face Recognition System.
AI in Health Care, Medical Imaging, Role, Benefits and Tools of AI

11+4 Hours

Unit -III:

Natural Language Processing and Natural Language Communication

Natural Language Processing- Language Models, Text Classification, Information Retrieval and Information Extraction. **Natural Language Communication-** Phrase Structure Grammars, Syntactic Analysis, Augmented Grammars and Semantic Analysis, Machine Translation and Speech Recognition. Case Study: Automatic Speech Recognition System. **Case Study I**: Understand the development and deployment of AI Chat Bots.
Question and Answer Problem, Information extraction and Translation, Corpus,

12+4 Hours

Unit -IV:

Robotics and Impact of AI on Human Labor and Social Equity

Robotics- Robot Hardware- Robot Perception- Planning to Move- Planning Uncertain Movements- Planning Moves- Robotic Software Architectures and Domains. **Impact of AI on Human Labor and Social Equity** - Benefits on this Technological Revolution- Need and Necessity of Labor based Economy and Society- Distribute future assets more equitably-Support for Unemployed.

Future Impacts of AI, Fault Detection, Diagnosis and Optimization.

12+4 Hours
Total: 45+15 = 60 Hours

Text Book (s)

1. Russel and Norvig, Artificial Intelligence A Modern Approach, 4th Edition, Pearson Education 2021.
2. Stevan Finaly, Artificial Intelligence for Everyone, Relativistic Publications, Great Britan,2020.
3. E. Rich K. Knight and B.Nair – Artificial Intelligence– Third Edition – Tata McGraw Hill, 2017.
4. Jerry Kaplan, Artificial Intelligence- What everyone needs to know, Oxford University Press,2016.

Reference (s)

1. Artificial intelligence: a very short introduction; Margaret A. Boden; Oxford University Press; 2018.
2. Artificial Intelligence and Social Work; Milind Tambe, Eric Rice; Cambridge University Press; 2018.
3. Artificial Unintelligence; Meredith Broussard; The MIT Press; 2018.
4. Tom M. Mitchell, ―Machine Learning, McGraw-Hill Education (India) Private Limited, 2013.

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Open Book Exam [5] (%)
Remember	25	20	-
Understand	35	40	30
Apply	40	40	40
Analyze	-	-	30
Evaluate	-	-	-
Create	-	-	-
Total (%)	100	100	100

Sample question (s)

Remember

1. Define AI.
2. List any five AI applications.
3. Define a curve matrix.

Understand

1. What is an Expert System??
2. How perception and biometrics differ w.r.tAI?
3. Explain confusion matrix with an example

Apply

1. Write a program to convert text to speech.
2. Develop a robot using an AI simulating software.
3. Write a program to demonstrate the working of the expert system to trace its decision.

Open Book Question(s)

1. Mr Neerukonda is a famous real estate agent and always busy with uplift of houses in the nearby villages and small cities. He one day popped with his busy schedule, came into a decision to build a model to predict House prices by taking a coder help called Mr Trevedhi, who was a gem in Artificial Intelligence. Mr Neerukonda, started off by collecting data on the houses in the areas which he is most interested and nearby too. Assuming that thousands of sample houses data is collected, where each sample contained information on a given house's properties and handed over the details to Mr Trivedhi. Among these properties include the number of bedrooms, number of bathrooms and square footage. Common sense would lead anyone to believe that there is relationship between the number of bedrooms, the number of bathrooms and the square footage of the house. In other words, anyone can easily suspect that the higher the square footage of a house, the more bedrooms, and bathrooms it contains. If the properties are highly correlated, is it necessary that should we have three individuals

for the same underlying property in size, do explain and help Mr Trivedhi to resolve this and provide a solution to Mr Neerukondas Query. Apply relevant common-sense reasoning and help Mr Trivedhi to determine which of the variables accounts for the most variance in house price, suggesting him an algorithm for solving the same representing with both procedure and pictorial model.

2. Vamsi and Tirumalesh are two best friends, who does all the activities in parallel either in college or in their room. It might depend on various factors like whether or not these two get free from the college on time and able to leave on time, whether they can reach room before 7 pm in the evening depending upon traffic or whether their roommates have some other activity already scheduled that day; in all the cases, their decision to go out to play a game, tennis with their roommates depends mainly upon the particular day and its endure. If everything is fine, and if they are free from college and reach the room in time and if their roommates doesn't have any other class, may want to go out to the tennis court with them. If they reach on time but already has some other activity scheduled that day, they might want to just relax at room, writing the record. Determine and suggest the best algorithm for solving the same.

19CH016 Green Technologies

0 0 0 3

Course Objectives:

1. Understand the principles of green chemistry and engineering.
2. Familiarize with Environmental green standards
3. Design processes those are benign and environmentally viable.
4. Utilize Nano technological principles for better environment
5. Design processes and products those are safe and hazard free.
6. Modify chemical processes making hazardous products and make them green safe and economically acceptable by using biotechnology.

CO-PO Mapping

CO	PO_2	PO_6	PO_7
1	3	3	3
2	3	3	3
3	3	3	3
4	3	3	3
5	3	3	3
6	3	3	3

3–Strongly linked | 2–Moderately linked | 1–Weakly linked

Syllabus

UNIT- I

Fundamentals of Green Chemistry and Technology- The twelve Principles of Green Chemistry and green engineering with examples Principles of Green Chemistry and technology, green chemistry metrics, atom economy, atom efficiency, E-factor, and other green chemistry metrics.

UNIT- II

Industrial Safety and Hazard analysis- Introduction to ISO standards, hazard identification, life cycle analysis, and safety aspects related to transport, handling and storage of hazardous chemicals. green technologies for addressing the problems of Water, Energy, Health, Agriculture and Biodiversity- WEHAB -eco-restoration- phyto-remediation, ecological sanitation, renewable energy technologies, industrial ecology, agro ecology and other appropriate green technologies , global warming; greenhouse gas emissions, impacts, mitigation and adaptation.

UNIT- III

Green processes- Microwave assisted reactions, ultra-sonication assisted reactions, ionic liquids as solvent, water as a reaction medium, solvent free reactions, supercritical solvents, safe product and process design, case studies Green Nanotechnology – Nanomaterials for water treatment, nanotechnology for renewable energy, nanotechnology for environmental remediation and waste Management, nanotechnology products as potential substitutes for harmful chemicals, environmental concerns with nanotechnology

UNIT- IV

Concept of Cleaner Production, Definition of Cleaner Production, Cleaner Production and End of Pipe Solution, Good House Keeping checklist, tools to be discuss in details with example, Material and Energy Balance of Process, CP Methodology, Barriers and Drivers in cleaner production, Case studies Green Productivity concepts, methodology & techniques, Guidelines of APO on Green Productivity, CEPI Index Emerging technologies and their techno economic evaluation

Text Book (s)

1. Clark, James H., and Duncan J. Macquarrie, eds. Handbook of green chemistry and technology. John Wiley & Sons, 2008.

Reference Book (s)

1. Lancaster, Mike. Green chemistry: an introductory text. Royal society of chemistry, 2020.
2. Lapkin, Alexei, and David Constable. Green chemistry metrics. Wiley, 2008.
3. Manahan, Stanley. Environmental chemistry. CRC press, 2017.
4. Matlack, Albert. Introduction to green chemistry. CRC press, 2010.
5. Anastas, Paul T., and John C. Warner. "Green chemistry." Frontiers 640 (1998): 1998.
6. Dr Bharat Jain, Cleaner Production and its implementation in Industries, GCPC, 2017

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Assignment test (%)
Remember	20	20	10
Understand	40	40	40
Apply	40	40	50
Analyze	--	--	--
Evaluate	--	--	-
Create	--	--	--
Total (%)	100	100	100

Sample Question (s)

Remember

1. List various benefits of cleaner production.
2. Write the differences between cleaner production and end-of-pipe approach.
3. List the major non-conventional energy resources in India?

Understand

1. Discuss how you identify the opportunities to better assess cleaner production.
2. Write about environmental management hierarchy.
3. Discuss the future need of conventional energy resources.
4. Write the sustainability of geothermal energy in Indian practice.
5. Discuss the strategies in detail how to achieve sustainable development in a country through green technologies.

Apply

1. Explain in detail the factors affecting green technologies.
2. Discuss various barriers of cleaner production process. Also write the processes which do not come under cleaner production.
3. Write the problems, causes and possible solutions for cleaner production Financing.
4. Discuss in details methods for analyzing data and effectiveness in prevention of pollution and achieving cleaner production.
5. Discuss how important to utilize wind based and solar based energy with the associated principles.

19IT015 Human Computer Interaction

0 0 0 3

Course Outcomes

At the end of the course students will be able to

1. Demonstrate the capabilities of both humans and computers from the viewpoint of human information processing.
2. Understand typical human–computer interaction (HCI) models, styles, and various historic HCI paradigms.
3. Understand interactive design process and universal design principles to designing HCI systems
4. Apply HCI design principles, standards and guidelines.
5. Understand user models, user support, socio-organizational issues, and stakeholder requirementsof HCI systems
6. Understand HCI issues in groupware, ubiquitous computing, virtual reality, multimedia, and WordWide Web-related environments.

COs – POs Mapping

COs	PO_1	PO_7
1	1	3
2	1	3
3	3	1
4	1	2
5	2	3
6	1	2

3–Strongly linked | 2–Moderately linked | 1–Weakly linked

Syllabus

Unit I

Introduction

Importance of user Interface-definition, importance of good design, Benefits of good design, A brief history of Screen design, The graphical user interface-popularity of graphics, the concept of direct manipulation, graphical system, Characteristics, Web user-Interface popularity, characteristics-Principles of user interface.

Design methodologies-participatory design-Usability and tests-Acceptability tests

10+5 Hours

Unit II

Design process

Human interaction with computers, importance of human characteristics human consideration, Human interaction speeds, understanding business junctions, Screen Designing:-Design goals-Screen planning and purpose, organizing screen elements, ordering of screen data and content-screen navigation and flow-Visually pleasing composition- amount of information-focus and emphasis-presentation information simply and meaningfully-information retrieval on web-statistical graphics-Technological consideration in interface design.

Design Visual thinking-virtual-environments-item presentation sequence-layout-form fill-in dialog boxes

10+3 Hours

Unit III

Windows

New and Navigation schemes selection of window, selection of devices based and screen based controls, Components-text and messages, Icons and increases-Multimedia, uses problems, choosing colors.

Goals of Co-operation-asynchronous interactions-synchronous distributed-application to education-social uses

12+4 Hours

Unit IV

Software Tools and Interaction Devices

Specification methods, interface-Building Tools, Keyboard and function keys, pointing devices-speech recognitiondigitization and generation-image and video displays-drivers.

Database query and phase search in documents, multimedia document searches, information visualization

13+3 Hours

Total: 45+15 Hours

Textbook (s)

1. Wilbert O Galitz, Wiley Dream Tech, The essential guide to user interface design, 3rdEdition, Wiley Computer Publishing, 2007.
2. Ben Shneidermann, Designing the user interface, 3rd Edition, Pearson Education Asia, 2008.

Reference (s)

1. Alan Dix, Janet Fincay, GreGoryd, Abowd, Russell Bealg, Human Computer Interaction., 3rd EditionPearson Education, 2004.

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Open Book Exam (%)
Remember	40	40	--
Understand	60	40	80
Apply	--	20	20
Analyze	--	--	--
Evaluate	--	--	--
Create	--	--	--
Total (%)	100	100	100

Sample Question (S)

Remember

1. Define Human Computer Interaction.
2. What is the basic goal of Human Computer Interaction?
3. State the long term goal of HCI
4. List the factors HCI designers must consider for User Interface Design

Understand

1. Demonstrate the HCI importance.
2. Extend the Trouble faced by human with Computers.
3. Illustrate Psychological Responses to Poor Design
4. Interpret Human-factor variables used in Comparison of pointing devices

Apply

1. Identify the amount of Information need to present in a page.
2. Organize the different Software tool specification methods.
3. Model out the six types interaction tasks properties of Pointing devices (For Open Book Examination and not for semester end examination)

19BS006 Handling of Industrial waste and waste water

0 0 0 3

Course Outcomes

1. Understand the procedures for assessment of quality of Industrial water and processes of handling of waste water.
2. Demonstrate the utilization of waste water in industry by adopting different processes.
3. Explain the sampling, preservation and characterization of waste water and its treatment.
4. Understand the discharge of industrial waste water into water bodies and its management.
5. Illustrate the functioning of effluent treatment plants and effluent disposal.
6. Identify the nature of liquid waste coming from different industries and propose the suitable treatment techniques.

COs–POs Mapping

COs	PO1	PO7
1	2	3
2	2	3
3	2	3
4	2	3
5	2	3
6	2	3

3–Strongly linked | 2–Moderately linked | 1–Weakly linked

Unit I

Requirement of Quality and Quantity of water to Industry

Process water for industries like Textiles, Food processing, power plants, fertilizers, pharma, Selection of water source based on quality and quantity. Utilization of Municipal wastewater in Industries, waste water treatment-Adsorption, Reverse Osmosis, Ion Exchange, Ultra filtration, Elutriation, Removal of Colour, Odour and Taste.

Waste Water composition in steel industry

11+3 Hours

Unit II

Industrial Wastewater Management

Survey on Industrial waste –evaluation of industrial waste water Flow-generation rates – Sampling of Industrial wastewater and preservation of samples for analysis - characterization of waste water-Toxicity of industrial effluents-Treatment of wastewater, recycling, reuse and recovery of resources.

Proper handling of waste water

12+4 Hours

Unit III

Discharging of Industrial wastewater

Discharges into Streams, Lakes and oceans and associated problems, Land treatment - Common Effluent Treatment Plants: advantages and suitability, Limitations and challenges- Recirculation of Industrial Wastes- Effluent Disposal Method *Discharge levels of toxic contaminants in industrial effluent*

11+4 Hours

Unit IV

Processing and treatment of waste water

Water utilization in manufacturing Process, origin, characteristics, effects and treatment methods of liquid waste from industries like (i) Steel plants (ii) Fertilizers (iii)Textiles (iv) Paper and Pulp industries (v) Pharmaceutical Plants.

Removal of dyes from the industrial waste water

11+4 Hours

Total: 45+15 Hours

Text Book(s)

1. M. N. Rao and A. K. Dutta, "Wastewater Treatment", 3rd Ed., Oxford & IBH Publishing, 2020.
2. K.V. S. G. Murali Krishna, "Rural, Municipal and Industrial Water management", Reem Publications, 2008.
3. Metcalf & Eddy Inc., "Wastewater Engineering: Treatment and reuse", 4th Ed., McGraw Hill Education (India), 2017.

Reference(s)

1. A. D. Patwardhan, "Industrial Wastewater treatment", 2nd Ed., PHI Learning, 2017.
2. G. L. Karia and R.A.Christian, "Wastewater Treatment: Concepts and Design Approach", 2nd Ed., Pentice Hall India Learning Private limited, 2013.

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Open Book Exam (%)
Remember	30	30	--
Understand	50	50	50
Apply	20	20	50
Analyse	--	--	--
Evaluate	--	--	--
Create	--	--	--
Total (%)	100	100	100

Sample questions(s)

Remember

1. What is meant by industrial waste water?
2. What is the composition of steel industry waste water?

Understand

1. Explain the treatment methods for generation of liquid waste from textile industry
2. Explain the process of separation of particles from industrial waste by Elutriation method
3. Illustrate the industrial waste discharges into oceans

Apply

1. How the industrial wastes are purified by using effluent plants?
2. Illustrate what measurements are taken in the handling of preservation of different industrial waste samples.
3. Compare the handling of different industrial waste waters

Open Book Exam question

1. In industrial area, one of the industry discharges waste waters, how to identify toxicity of industrial effluents in that water. Suggest and explain the process for that industrial waste water to purification, recycling and reuse

19CS021 Fundamentals of Cyber Security

0 0 0 3

Course Outcomes

1. Understand the fundamentals of security and cryptography.
2. Explain the different attacks and services of security.
3. Make use of cryptography types and techniques.
4. Interpret the functionalities of cyber crime and cyber law.
5. Demonstrates the functionalities of firewalls
6. Explain various non-cryptographic protocol vulnerabilities

CO–PO Mapping

CO	PO3	PO6	PO8
1	2	2	3
2	2	2	3
3	2	1	3
4	2	1	2
5	2	2	3
6	2	2	2

3–Strongly linked | 2–Moderately linked | 1–Weakly linked

Unit I **11+3 Hours**

Introduction: What is Security, Data, Information, Attack, Hacker, Goals of Security, Security concerns in computer, web technology, World Wide Web, Internet, Data Transfer, Society, Banking, etc. Individual in information technology, Models for Network Security, Security Terminologies, CIA Traid, Security Attacks, Security Goals, Methods of Defence, Security Services, Security Mechanisms

Types of Hackers, hacking, network sniffing.

Unit II **11+4 Hours**

Basics of Cryptography: Introduction to cryptography, Cryptographic functions(Authentication, Nonrepudiation, confidentiality, integrity), Cryptanalysis. Types of Cryptography: Symmetric key and Asymmetric Key Cryptography, Principles of Private and Public Key System, Symmetric Cipher Model, Substitution Techniques, Transportation Techniques, Modes of Operations, Message Integrity, Encryption and Decryption Techniques, Digital Signatures.

Applications of Cryptography, cipher types, steganography

Unit III **12+4 Hours**

Cyber crime and Cyber law: Classification of cyber crimes, Common cyber crimes, cyber crime targeting computers and mobiles, cyber crime against women and children, financial frauds, social engineering attacks, malware and ransomware attacks, zero day and zero click attacks, Reporting of cyber crimes, Remedial and mitigation measures, Legal perspective of cyber crime, IT Act 2000 and its amendments, Cyber crime and offences, Organisations dealing with Cyber crime and Cyber security in India,

Cybercrime vs Computer Crime, *Case studies*.

Unit IV **11+4 Hours**

IDS and Firewalls: Intruders, Intrusion Detection, Password Management, Firewalls-Characteristics, Types of Firewalls, Placement of Firewalls, Firewall Configuration, Trusted Systems. **Non-cryptographic protocol Vulnerabilities:** DoS, DDoS, Session Hijacking and Spoofing, Software Vulnerabilities- Phishing, Buffer Overflow.

SQL Injection, Intellectual Property.

Total: 45+15=60 Hours

Textbook (s)

1. William Stallings, Lawrie Brown, Computer Security Principle sand Practice Third Edition,2015
2. Nihad A. Hassan, Rami Hijazi, Digital Privacy and Security Using Windows: A Practical Guide,
3. Apress, 2017
   William Stallings, "Cryptography And Network Security – Principles and Practices", 7th edition, Pearson Education Limited 2017.

Reference (s)

1. Michael T. Goodrich and Roberto Tamassia, Introduction to Computer Security, Addison Wesley, 2011.
2. Ross Anderson, Security Engineering: A Guide to Building Dependable Distributed, 3rd Edition, John Wiley & Sons Inc, 2021.
3. Kozierok, Charles M. The TCP/IP guide: a comprehensive, illustrated Internet protocols reference, 2005
4. Cyber Crime Impact in the New Millennium, by R. C Mishra , Auther Press. Edition 2010.
5. Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives by Sumit Belapure and Nina Godbole, Wiley India Pvt. Ltd. (First Edition, 2011)
6. Security in the Digital Age: Social Media Security Threats and Vulnerabilities by Henry A. Oliver, Create Space Independent Publishing Platform. (Pearson , 13th November, 2001)
7. Harris, Shon, "CISSP all-in-one exam guide." Sixth edition (2013).
8. OWASP top ten security vulnerabilities: http://xml.coverpages.org/OWASPTopTen.pdf

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Open Book Exam (%)
Remember	30	30	--
Understand	40	40	--
Apply	30	30	50
Analyze	--	--	50
Evaluate	--	--	--
Create	--	--	--
Total (%)	100	100	100

SAMPLE QUESTION (S)

Remember

1. Mention any two security attacks
2. List any two goals of security
3. Define Cryptography

Understand

1. Differentiate between asymmetric and symmetric key cryptography
2. How do we achieve authentication?
3. Differentiate between Cyber Crime and Computer Crime.

Apply

1. Implement firewall using iptables command.
2. Can message encryption itself provide measure of authenctication?

Open Book Exam Questions

Question 1:

A man named Jones wanted to chat with his girlfriend Goldie. But he can see that all his family is around him and even his girlfriend is also with her parents. So, he thought to send a secret message to his girlfriend. They usually love to meet in the “Central Park”. Now jones wants to send a message to Goldie as “Hi Goldie. How are you. Because you are with your parents, and I am with my parents we cannot speak with each other. But I want to meet you at our favorite place central park tomorrow after your class”. Help jones to convert the message to unreadable format using the key of their favorite place. Also suggest him how would jones tell Goldie that the letter is originated from jones only.

Question 2:

You have decided to start a startup after graduation. But you alone cannot be doing this, so you have to ask help from your friends. Suggest what techniques you require and which sort of people you would select so that your company will be a huge success. Explain the techniques clearly to your friends and tell them what they have to do in detail.

19EC012 Fundamentals of Embedded Systems

0 0 0 3

Course Outcomes

1. Interpret embedded system architecture.
2. Illustrate the Quality Attributes to be optimized during embedded system design.
3. Classify the communication interface of embedded system.
4. Explain the hardware and firmware development.
5. Summarize the embedded target boards.
6. Demonstrate interfacing of sensors, actuators and IO peripherals with embedded boards

COs – POs Mapping

COs	PO_1	PO_2
1	2	2
2	2	2
3	2	2
4	2	2
5	2	2
6	3	2

3–Strongly linked | 2–Moderately linked| 1–Weakly linked

Unit I

Introduction to Embedded Systems

Embedded Systems - Definition, Structure, Characteristics and Examples. Quality Attributes (Non-operational & Operational), Core of Embedded System, Memory: Masked ROM, Programmable ROM, EPROM, EEPROM, Flash, RAM) Microprocessor vs Microcontroller, Harvard and Von-Neumann Architecture, RICS vs CICS Architecture, Little-Endian vs Big-Endian Processor, Classification of Embedded System Based on Generation, Complexity and Performance, Embedded System vs. General Computing System.

Reset Circuit, Watchdog Timer

11+3 Hours

Unit II

Communication Interfaces

On board communication interfaces: Inter Integrated Circuit (I2C), Serial Peripheral Interface (SPI), Universal Asynchronous Receiver Transmitter (UART). Off board communication interfaces: RS232, Universal Serial Bus (USB), BLUE TOOTH, WIFI, ZigBee.

1-Wire Interface, GPRS

12+4 Hours

Unit III

Hardware and firmware development

Embedded firmware design approaches and development languages, Embedded C, Fundamental Issues in Hardware and Software Co-Design, Hardware software tradeoffs, Integration of Hardware and Firmware. CAD and hardware Translation tools. Pre-processors, Interpreters, Compilers, Linkers. Debugging tools, Simulators and Laboratory tools. Features of Real-Time Operating System.

Assembler, Features of General Purpose Operating System

11+4 Hours

Unit IV

Embedded target boards and Interfacing

Embedded target boards: Features of Arduino Board, Raspberry- pi and ESP8266. Sensors: temperature sensor, humidity and temperature sensor, light dependent sensor, touch sensor, ultrasonic sensor, soil moisture sensor. Actuators: DC Motor, Stepper Motor, Motor Driver L293D, Relay. I/O Devices: 7-Segment Display, LCD, Keypad. Interfacing of Embedded target board with sensors, actuators and IO devices.

Smoke detector, Rain detector

11+4 Hours

Total: 45+15=60 Hours

Textbook (s)

1. Shibu .K.V, Introduction to Embedded Systems, 1st Ed, Tata McGraw Hill Education Private Limited, 2009.
2. Yogesh Misra, Programming and Interfacing with Arduino, CRC Press, 1st Edition, 2021

Reference (s)

1. Frank Vahid, Tony D. Givargis, Embedded System Design-A Unified Hardware/Software Introduction, Wiley Publications, 2002
2. Raj Kamal , Embedded Systems, TMS, Second Edition, 2008

Sample Question (S)

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Open Book Exam (%)
Remember	15	15	--
Understand	85	60	--
Apply	--	25	100
Analyse	--	--	--
Evaluate	--	--	--
Create	--	--	--
Total (%)	100	100	100

Remember

1. Define embedded system.
2. List any three on board and off board communication interfaces.
3. List any two embedded development boards.

Understand

1. Exemplify the SPI protocol for on board communication interface.
2. Exemplify the I2C protocol for on board communication interface.
3. Demonstrate the purpose of compiler and linker in firmware design.
4. Illustrate the different components of Arduino UNO board.
5. Illustrate the working of capacitive touch sensor.

Apply

1. Construct an interfacing diagram of LCD with Arduino board.
2. Construct an interfacing circuit of 220 V ac operated bulb with Arduino board.
3. Interface a temperature sensor with Arduino UNO board.