

Ref.No. NMAMIT/VP & Dean (Aca)/2023/ 97

18.12.2023

CIRCULAR

The Open Electives (along with the syllabus) offered to 8th semester students during the EVEN semester period (January to June 2024), is uploaded in the moodle. All 8th semester students are hereby informed to register one open elective online (172.16.2.10/oe) or (guru.nmamit.in/oe).

Online registration will be kept open through moodle from 26/12/2023 (10.00 a.m.) to 29/12/2023 (12.00 noon).

Note:

- 1) The open elective along with the syllabus is uploaded in the moodle.
- 2) The registration fee for "Introduction to German Language" is Rs.500/-.
- 3) The registration fee for "Introduction to Japanese language: is Rs.1500/-
(Students with no backlogs, CGPA should be above 7.0 & who have intention to work for Japanese companies in India or Japan. Classes will be held on Saturdays)
- 4) Introduction to Yoga classes will be conducted from 6.30 a.m. to 7.30 a.m. Those who are willing to come at 6.30 a.m. should only register).


DEAN ACADEMICS



PRINCIPAL

Cc to:

Principal's Table
COE & Vice Principal
Dr. Srinivas Pai P - Deputy Dean (Academic)
To all HoD's - Civil, BT, CSE, ISE, E&C, E&E, Mechanical, CCE, AIML, Phy, Chemistry, Mathematics,
Humanities - Request to display in the notice board
Mr. Rajeevan - System Analyst, Academic Sec. Office Automation Cell
College Notice Boards, Notice Board - Gents & Ladies hostel.

OPEN ELECTIVE - II (VIII Semester)

Sl. No	Code	Name	Intake
1.	20MA8X01	Graph Theory (for all except CS, IS, CCE & AIML)	60
2.	20HU8X03	Intellectual property rights (for all except for those who have taken the subject in the VII semester)	65
3.	20CV8X07	Environment Impact Assessment (for all except Civil & except for those who have taken the subject in the VII semester)	60 (Regular) 60 (Fasttrack)
4.	20ME8X08	Industrial Pollution Control (for all except Mechanical & except for those who have taken the subject in the VII semester)	60
5.	20EE8X10	Non-Conventional Energy Systems (for all except EE, Mech.)	60 (Regular) 60 (Fasttrack)
6.	20CS8X15	Essentials of Information Technology (for all except CS, CCE, AIML & IS)	60
7.	20EC8X18	Consumer Electronics (for all except EC)	60
8.	20ME8X28	Operations Management and Entrepreneurship (for all except Mechanical & except for those who have taken the subject in the VII semester)	60 (Regular) 60 (Fasttrack)
9.	20ME8X33	Human Resource Management (for all except Mechanical)	60
10.	20HU8X37	Linguistics and Language Technology (for all)	60
11.	20BT8X40	Bio Fuel Engineering (for all except BT & except for those who have taken the subject in the VII semester)	60
12.	20MA8X43	Number Theory (for all)	60
13.	20ME8X65	Automotive Engineering (For all except Mechanical)	60
14.	20CV8X67	Disaster Management (For all except Civil)	60
15.	20HU8X68	Introduction to Yoga (for all except for those who have taken the subject in the VII semester) (The classes will be conducted from 6.30 a.m. to 7.30 a.m.)	50
16.	20HU8X72	Introduction to Japanese language (for all except for those who have taken the subject in the VII semester) (Students with no backlogs, CGPA should be above 7.0 & who have intention to work for Japanese companies in India or Japan) – Registration fee for this subject is Rs.1500/- & classes will be held on Saturday)	60
17.	20HU8X74	Introduction to German Language (for all except for those who have taken the subject in the VII semester) Registration fee for this subject is Rs.500/-	50
18.	20ME8X75	Sustainable Development Goals (for all except for those who have taken the subject in the VII semester)	60
19.	20CS8X80	Internet of Things (for all except EC, CS, CCE, AIML & IS)	30
20.	20IS8X83	Software Engineering Practices (for all except CS, AIML, CCE & IS)	60
21.	20IS8X84	Introduction to Cyber Security (for all except CS, CCE & IS)	60
22.	20EC8X85	Space Technology & Applications (for all except E&C)	60
23.	20ME8X88	Marketing Management (for all except Mechanical)	60
24.	20CC8X94	Next Generation Wireless Networks (for all except CCE)	60
25.	20AI8X95	Introduction to Artificial Intelligence & Machine Learning (for all except AIML, CCE, CS & IS)	60
Total			1635


P. Prithvika
 Vice - Principal (Administration)
 & Dean (Academics)
 NITAM Institute of Technology
 P. TE - 574 110

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24.	20CC8X94	Next Generation Wireless Networks (for all except CCE)	60
25.	20AI8X95	Introduction to Artificial Intelligence & Machine Learning (for all except AIML, CCE, CS & IS)	60
Total			1635

GRAPH THEORY

Course Code	20MA8X01	CIE Marks	50
Teaching Hours/Week (L:T:P)	3:0:0	SEE Marks	50
Total Hours	39	Credits	03

Course Learning Objectives:

1. Explain subgraphs, bipartite graphs, isomorphic graphs etc. Apply the concept of trees and its properties
2. Distinguish between Hamilton and Eulerian graph. Distinguish between planar and nonplanar graphs and apply their properties to solve problems.
3. Represent a graph in terms of adjacency matrix, incidence matrix etc. and vice-versa.
4. Find the shortest path between two vertices in a graph. Find minimal spanning tree.

UNIT – I

Introduction to graphs

11 Hours

Graphs and Graph Models, digraphs, Konigsberg bridge problem. Special Types of Graphs: Subgraphs-spanning and induced subgraphs, Isomorphism of graphs. Some Special Simple Graphs, complete graph, Bipartite Graphs.

Connectivity: point and line connectivity

Trees and its properties.

Euler and Hamilton graphs

4 Hours

Eulerian and Hamiltonian graphs and their applications.

UNIT – II

Planar graphs: Euler's polyhedron formula, outer planar graphs, applications

9 Hours

Colorability: Chromatic number, five color theorem, chromatic polynomial, Applications of graph coloring.

Representation of graphs:

6 Hours

adjacency matrix, incidence matrix, circuit matrix, cut set matrix. Path matrix

UNIT – III

Network Flows: Max -flow and Min-cut Theorem(statement), problems.

04 Hours

Shortest paths in weighted graphs:

Dijkstra's algorithm to find shortest paths.

Spanning trees:

05 Hours

Algorithms to find a spanning tree, minimal spanning tree-Kruskal's & Prim's algorithm.

Course Outcomes: At the end of the course student will be able to

1.	Distinguish between bipartite and complete bipartite graphs, identify whether two graphs are isomorphic, find subgraphs of a graph etc.
2.	Distinguish between Eulerian and Hamiltonian graphs.
3.	Identify whether a graph is planar and to find the chromatic polynomial of a graph.
4.	Representing graphs in Matrices.
5.	Apply algorithmic methods to find the shortest path between two given vertices. Use a suitable algorithm to find a minimal spanning tree.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	1	2	3	4	5	6	7	8	9	10	11	12
↓Course Outcomes												
CO1	3	3										
CO2	2	1										
CO3	2	3										
CO4	3	2										
CO5	3	2										

1: Low 2: Medium 3: High

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The student must obtain minimum of 40% marks individually both in CIE and SEE to pass. Theory Semester End Exam (SEE) is conducted for 100 marks (3 Hours duration). Based on this grading will be awarded.

Continuous Internal Evaluation:

1. Methods recommended: Two Tests (80%), Written Quiz (10%) and module assignments (10%).
2. The class teacher must decide the topic for closed book test and Written Quiz. In the beginning only teacher must announce the methods of CIE for the subject.

Semester End Examination:

There will be **8** questions of **20** marks each in the question paper categorized into **3 Units** as per the syllabi & contact hours. The student will have to answer **5** full questions, selecting **2** full questions each from **Unit - I&Unit - II** and **1** full question from **Unit - III**.

TEXTBOOKS:

1. F. Harary, "Graph theory", Narosa Publishing House, 1988.
2. Narsing Deo, "Graph Theory with applications to Engg. and Comp. Sciences", PHI, 1974.
3. "Discrete Mathematics and its applications", Kenneth H. Rosen, Tata McGraw Hill, V Edition - 2003.

REFERENCE BOOKS:

1. D.B. West, "Introduction to Graph Theory", PHI, 2001.
2. Chartrand and Zhang, "First Course in Graph Theory", 2012

E Books / MOOCs/ NPTEL

1. <http://diestel-graph-theory.com>.
2. <https://nptel.ac.in/courses/111106102>

INTELLECTUAL PROPERTY RIGHTS

Course Code	20HU8X03	Course Type	OEC
Teaching Hours/Week (L:T:P: S)	3:0:0:0	Credits	03
Total Teaching Hours	39+0+0	CIE + SEE Marks	50+50

Teaching Department: Humanities

Course Learning Objectives:

1. Understand the creativity component in intellectual property, different types of legal protection of intellectual properties and other basic concepts of Intellectual property.
2. Analyze different types of protection for inventions, different types of agreements and treaties for Intellectual properties with an ability to examine patent types, specifications and patent search and database for 'prior art'.
3. Understand the basic procedure of drafting claims, apply for patents, other legal forms of intellectual property rights and also to examine the protocol involved in protection of inventions like patents.

UNIT - I	
<p>Introduction to Intellectual Property Invention and Creativity - Intellectual Property (IP) – Importance, Jurisprudential definition and concept of property, rights, duties and their correlation; History and evaluation of IPR – like Patents, Trademarks, Copyright & Related Rights, Industrial Design, Traditional Knowledge, Geographical Indications.</p>	8
<p>Agreements and Treaties History - General Agreement on Trade and Tariff (GATT). Indian Position vis-a-vis WTO and Strategies; TRIPS Agreement; Madrid Agreement; Hague Agreement; WIPO Treaties; International convention relating to Intellectual Property - Establishment of WIPO - Mission and Activities – Budapest Treaty; PCT; Indian Patent Act 1970 & recent amendments – Patent (Amendment) Rules, 2017</p>	8
UNIT - II	
<p>Basics of Patents and Concept of Prior Art Introduction to Patents; Types of patent applications: Ordinary, PCT, Conventional, Divisional and Patent of Addition; Specifications: Provisional and complete; Forms and fees Invention in the context of “prior art”; Patent databases; Searching International Databases; Country-wise patent searches (USPTO, EPO, WIPO, IPO, etc.)</p>	8

Patent filing procedures National & PCT filing procedure; Time frame and cost; Status of the patent applications filed; Structure of Patent document, Precautions while patenting – disclosure/non-disclosure; Financial assistance for patenting - introduction to existing schemes; Patent licensing and agreement; Patent infringement- meaning, scope, litigation, case studies														8	
UNIT - III															
Case Studies: Patents: Biological Cases - i) Basmati rice ii) Turmeric iii) Neem; Non-biological cases – (i) TVS V/S Hero, (ii) Samsung V/S Nokia – Copyright and related rights – Trade Marks – Trade secrets - Industrial design and Integrated circuits – Geographic indications – Protection against unfair competition; Technology transfer and license agreements (US anti-HIV drug license to Africa)														7	
Course Outcomes: At the end of the course student will be able to															
1.	Have a General understanding of the Intellectual Property Rights.														
2.	Have awareness of different forms of intellectual property rights, national and international IPR related legislations.														
3.	Have a general understanding about the provisions, privileges and limitations of intellectual property right holders with an understanding of the legal aspects (civil or criminal) of the use of intellectual property rights.														
4.	Acquire Knowledge of National and International Trade Agreements and Agencies functioning in relation to intellectual property rights														
5.	Be aware and have a general understanding of patenting procedures and licensing.														
Course Outcomes Mapping with Program Outcomes & PSO															
↓ Course Outcomes	Program Outcomes→												PSO↓		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	
CO1		3	3	2		3			2	2		3			
CO2	2	2	3			3		3	1	1	2	2			
CO3	2			2		3			2	2	2	3			
CO4			1	1		3			1	2		3			
CO5	3	2	1			3			3	1		2			
1: Low 2: Medium 3: High															
REFERENCE MATERIALS:															
1.	BAREACT, Indian Patent Act 1970 Acts & Rules, Universal Law Publishing Co. Pvt. Ltd., 2007														
2.	Kankanala C., Genetic Patent Law & Strategy, 1st Edition, Manupatra Information Solution Pvt. Ltd., 2007														
3.	Subbaram N.R. "Handbook of Indian Patent Law and Practice", S. Viswanathan (Printers and Publishers) Pvt. Ltd., 1998.														
4.	Eli Whitney, United States Patent Number: 72X, Cotton Gin, March 14, 1794.														
5.	Intellectual Property Today: Volume 8, No. 5, May 2001,														
6.	WTO and International Trade by M B Rao. Vikas Publishing House Pvt. Ltd.														
7.	Correa, Carlos M. Intellectual property rights, the WTO and developing countries: the TRIPS agreement and policy options, Zed Books, New York 2000														
8.	Wadehra, B. L. Law relating to patents, trademarks, copyright designs & geographical indications 2 ed. Universal Law Publishing 2000														
9.	Sinha, Prabhas Chandra Encyclopedia of Intellectual Property Rights, 3 Vols. Eastern Book Corporation, 2006.														
10.	"Practical Approach to Intellectual Property Rights"; Rachna Singh Puri and Arvind Vishwanathan, I. K. International Publishing House Pvt. Ltd.														
E-RESOURCES:															
1.	http://www.w3.org/IPR/														
2.	http://www.wipo.int/portal/index.html.en														
3.	http://www.ipr.co.uk/IP_conventions/patent_cooperation_treaty.html														
4.	www.patentoffice.nic.in														
5.	www.iprlawindia.org/														

ENVIRONMENTAL IMPACT ASSESSMENT			
Course Code	20CV8X07	CIE Marks	50
Teaching Hours/Week (L:T:P)	3:0:0	SEE Marks	50
Total Hours	39	Credits	03

Course Learning Objectives:

This Course will enable students to

1. Identify the need to assess and evaluate the impact of projects on environment.
2. Explain major principles of environmental impact assessment.
3. Understand the different steps within environmental impact assessment.
4. Appreciate the importance of EIA for sustainable development and a healthy environment.

UNIT – I

Evolution of EIA: Concepts of EIA, EIA methodologies (Adhoc, Network Analysis, Checklists, Map overlays, Matrix method), Screening and scoping, Rapid EIA and Comprehensive EIA, General Framework for Environmental Impact Assessment, EIA Specialized areas like environmental health impact assessment, Environmental risk analysis.

16 Hours

UNIT - II

Baseline data study, Prediction, and assessment of impacts on physical, biological, and socio-economic environment, Legislative and environmental clearance procedures in India, Public participation, Resettlement, and rehabilitation.

10 Hours

UNIT – III

Fault free analysis, Consequence Analysis, Introduction to Environmental Management Systems, Environmental management plan-Post project monitoring Environmental Audit: Cost Benefit Analysis, Life cycle Assessment. Case studies on project, regional and sectoral EIA.

13 Hours

Course Outcomes:

At the end of the course the student will be able to

1. Understand phenomena of impacts and know the impact quantification of various projects in the environment.
2. Liaise with and list the importance of stakeholders in the EIA process.
3. Know the role of public in EIA studies.
4. Overview and assess risks posing threats to the environment.
5. Assess different case studies/examples of EIA in practice.

Course Articulation Matrix :

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1				2	3	2					2	3	
CO2	1	1				2	3	2					2	3	
CO3	1	1				2	3	2					2	3	
CO4	1	1				2	3	2		3			2	3	
CO5	1	1		3		2	3	2				3	2	3	

Note:- 1:Low 2:Medium 3: High

TEXTBOOKS:

1. Noble, L. 2010. Introduction to environmental impact assessment. A Guide to Principles and Practice. 2nd edition. Oxford University Press, Don Mills, Ontario.
2. Larry W. Canter, Environmental Impact Assessment, McGraw Hill Inc. Singapore, 1996

ADDITIONAL REFERENCE MATERIALS

1. Morris and Therivel, 2009. Methods of Environmental Impact Assessment, 3rd edition. New York, NY: Routledge.
2. Hanna, K.S. 2009. Environmental impact assessment. Practice and Participation. 2nd edition. Oxford, University Press, Don Mills, Ontario.

NPTEL SOURCES

<http://nptel.ac.in/courses/120108004/>

<http://nptel.ac.in/courses/120108004/module3/lecture3.pdf>

INDUSTRIAL POLLUTION CONTROL			
Course Code	20ME8X08	CIE Marks	50
Teaching Hours/Week (L:T:P)	3:0:0	SEE Marks	50
Total Hours	39	Credits	03

Course Learning Objectives: This Course will enable students to,	
1	Know the Consequences of pollution, relationship between man and environment over the last few decades, necessity of modern awareness on pollution and how carbon audit can help in developing a carbon strategy.
2	Identify the Importance of Meteorology in pollution control and global warming, various types of plume dispersions and its effect; analyze various levels of plume height for different pollutants.
3	Distinguish Particulates and fly ash separation techniques such as cyclone separator, electrostatic precipitator efficiency calculations etc.
4	Illustrate Formation, measurement and control techniques for Smoke and gaseous pollutants.
5	Summarize the Effects of water, soil, plastics and odor pollution their control techniques, Different Pollution Control Acts, Legal aspects of pollution control and how these acts can help in bringing down the pollution rate.
UNIT - I	
Introduction to Pollution	
Man and the environment, types of pollution and its consequences, Changing environmental management concept, sustainable industrial growth, carbon audit, Ill effects of various pollutants, permissible concentration levels & AQI.	
Meteorology	
Meteorology, Wind rose, Lapse rate, plume dispersion studies & Numerical problems	
15 Hours	

UNIT – II

Separation techniques

Different types of Particulates, Need for Separation techniques, Sources of Particulates Matter Fly Ash Electrostatic precipitator (Problems) Theory of settling processes (Design Problems), Bag House fabric filter Cyclone separator Spray Tower Scrubbers & Venturi Scrubber

Smoke and gaseous pollutants

Smoke- White, blue and black smoke, Sources of smoke, T,T,T-O Principle of smoke Measurement of stack smoke intensity using Ringlemann Chart and Smokescope & Bosch Smoke meter, Domestic and Industrial Incinerators-Design factors, Pollutant gaseous So₂, Co, UBHC, Nox their ill effects and & control methods..

15 Hours

UNIT – III

Water, soil, noise, and odor pollution, their control methods, problems associated with nuclear reactors, Legal aspects of pollution control in India, brief details of Euro and BS standards.
9 Hours

Course Outcomes:

At the end of the course the student will be able to

CO 1	Identify the various types of pollutants and distinguish between them with regards to Particulate matters and AQI.
CO 2	Outline the instruments for Meteorological measurements, distinguish types of plume dispersions and its effect; analyze the concentration of various gaseous pollutants from T-Z diagrams.
CO 3	Explain the Particulates and fly ash separation techniques, compare and Interpret their efficiency.
CO 4	Illustrate Formation, measurement and control techniques for Smoke and gaseous pollutants
CO 5	Identify Effects of water, soil, plastics and odor pollution on environmental Pollution and explain the Legal aspects of pollution control.

TEXTBOOKS:

1. “Environmental Pollution Control Engineering, *Wiley Eastern Ltd.*,
2. “Introduction to Environmental Engineering & Science”, Gilbert M Masters, PHI,1995
3. “Environmental Pollution Control Engineering, *C. S RAO New Age Int.*

REFERENCE BOOKS:

1. “*Air Pollution*”, Henry C. Perkins, Mc-Graw Hill, 1974.
2. “*Air Pollution control*”, W. L. Faith, *John Wiley*

MOOC/NPTEL Resources:

1. <http://nptel.ac.in/courses/105106119/36>

Course Articulation Matrix

Course Code / Name : 20ME8X08/ Industrial Pollution Control														
Course Outcomes (CO)	Program Outcomes (PO)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
C-20ME8X08.1	2								1	1		1		
C-20ME8X08.2	2								1	1		1		
C-20ME8X08.3	2								1	1		1		
C-20ME8X08.4	2								1	1		1		
C-20ME8X08.5	2								1	1		1		

1: Low 2: Medium 3: High

Scheme of SEE Question Paper

There will be **8** questions of **20** marks each in the question paper divided into **3 Units** as per the syllabi & contact hours and the student will have to answer **5** full questions, selecting **2** full questions from **Unit - I & Unit – II** and **1** full question from **Unit – III**.

NON-CONVENTIONAL ENERGY SYSTEMS			
Course Code	20EE8X10	CIE Marks	50
Teaching Hours/Week (L:T:P)	3:0:0	SEE Marks	50
Total Hours	39	Credits	03

Eligible Students: For all engineering stream except E&E and Mechanical Engineering

Prerequisite:

Students are expected to have a fundamental knowledge of Basic Electrical Engineering (18EE104)

Course Learning Objectives (CLO):

1. To illustrate the principle of extraction of energy from conventional, nonconventional sources.
2. To demonstrate the working principle and applications of solar based thermal, electrical and PV systems.
3. To justify the usage of energy storage techniques and understand the process of design and implement wind based energy conversion systems.
4. To understand the process of design and implement biomass based energy conversion systems.

UNIT – I

Energy Sources: Introduction, Importance of Energy Consumption as Measure of Prosperity, Per Capita Energy Consumption, Classification of Energy Resources, Conventional Energy Resources- Availability and their Limitations, Non-Conventional Energy Resources- Classification, Advantages, Limitations, Comparison of Conventional and Non-Conventional Energy Resources, World Energy Scenario, Indian Energy Scenario.

3 Hours

Solar Energy Basics: Introduction, Solar Constant, Basic Sun-Earth Angles – definitions and their representation, Solar Radiation Geometry (numerical problems), Estimation of Solar Radiation of Horizontal and Tilted Surfaces (numerical problems), Measurement of Solar Radiation Data – Pyranometer and Pyrheliometer.

5 Hours

Solar Thermal Systems: Principle of Conversion of Solar Radiation into Heat, Solar Water Heaters (Flat Plate Collectors), Solar Cookers – Box type, Concentrating dish type, Solar driers, Solar Still, Solar Furnaces, Solar Green House.

4 Hours

Solar Electric Systems: Solar Thermal Electric Power Generation, Solar Pond and Concentrating Solar Collector (Parabolic Trough, Parabolic Dish, Central Tower Collector), Advantages and Disadvantages; Solar Photovoltaic – Solar Cell fundamentals, characteristics, classification, construction of module, panel and array. Solar PV Systems- stand-alone and grid connected, Applications- Street lighting, Domestic lighting and Solar Water pumping systems.

4 Hours

UNIT – II

Energy Storage: Introduction, Necessity of Energy Storage and Methods of Energy Storage (Classification and brief description using block diagram representation)

4 Hours

Wind Energy: Introduction, Wind and its Properties, History of Wind Energy Wind Energy Scenario – World and India. Basic principles of WECS, Classification, Parts of a WECS, Derivation for Power in the wind, Electrical Power Output and Capacity Factor of WECS. Wind site selection consideration, Advantages and Disadvantages of WECS.

4 Hours

Biomass Energy: Introduction, Photosynthesis process, Biomass fuels, Biomass conversion technologies, Urban waste to Energy Conversion, Biomass Gasification, Biomass to Ethanol Production, Biogas production

from waste biomass, Factors affecting biogas generation, types of biogas plants- KVIC and Janata model, Biomass program in India

6 Hours

UNIT – III

Energy From Ocean: Tidal Energy – Principle of Tidal Power, Components of Tidal Power Plant, Classification of Tidal Power Plant, Estimation of Energy – Single basin and Double basin type TPP (no derivations, Simple numerical problems), Advantages and Limitation of TPP. Ocean Thermal Energy Conversion (OTEC): Principle of OTEC system, Methods of OTEC power generation – Open Cycle (Claude cycle), Closed Cycle (Anderson cycle), Hybrid cycle, Site-selection criteria, Biofouling, Advantages & Limitation of OTEC

5 Hours

Emerging Technologies: Fuel Cell, Small Hydro Resources, Hydrogen Energy and Wave Energy (Principle of Energy generation using block diagrams, advantages and limitations)

4 Hours

Course Outcomes:

At the end of the course student will be able to

1. Describe non-conventional energy sources and solar radiation geometry to estimate and measure solar radiation.
2. Apply the principle of solar radiation into heat to understand the operation of solar thermal and solar electric systems.
3. Describe energy storage methods and wind–energy conversion systems to understand the factors influencing power generation.
4. Review the biomass conversion technologies to design biomass-based energy systems.
5. Describe tidal, ocean thermal and fuel cell energy conversion systems to understand emerging non-conventional energy technologies.

Course Outcomes: Mapping with Program Outcomes												
Program Outcomes→	1	2	3	4	5	6	7	8	9	10	11	12
↓ Course Outcomes:												
20EE8X10.1	2	3				1	2	1				
20EE8X10.2	2	3				1	2	1				
20EE8X10.3	2	3				1	2	1				
20EE8X10.4	2	3				1	2	1				
20EE8X10.5	2	3				1	2	1				

1: Low 2: Medium 3: High

SEE Question Paper Pattern:

- There will be **8** questions of **20** marks each in the question paper categorized into **3 Units** as per the syllabi & contact hours. The student will have to answer **5** full questions, selecting **2** full questions each from **Unit - I&Unit – II** and **1** full question from **Unit – III**.

TEXTBOOK:

1. Rai G. D., “Non-Conventional Sources of Energy”, 4th Edition, Khanna Publishers, New Delhi, 2007

REFERENCE BOOKS:

1. Mukherjee D. and Chakrabarti, S., “Fundamentals of Renewable Energy Systems”, New Age International Publishers, 2005.
2. Khan, B. H., “Non-Conventional Energy Resources”, TMH, New Delhi, 2006
3. S. P. Sukhumi, J. K. Nayak “Solar Energy: Principles Collection and Storage”, 3rd edition, McGraw-Hill Education (India) , 2009

ESSENTIALS OF INFORMATION TECHNOLOGY			
Course Code	20CS8X15	CIE Marks	50
Teaching Hours/Week (L:T:P)	3:0:0	SEE Marks	50
Total Hours	39	Credits	03

Course Learning Objectives:

This Course will enable students to

1. Outline the fundamentals of python programming.
2. Implement the object oriented concepts using python programming.
3. Describe the basic concepts of Relational Database Management System.
4. Apply the normalization to the Databases and develop databases using SQL and PL/SQL Queries.
5. Develop the data base connectivity in integration with python and perform various Database operations.

UNIT - I

PROGRAMMING FUNDAMENTALS Introduction to Programming: Why Programming, What is Computer Program, What is an Algorithm, Flowchart, Pseudo Code; Python Fundamentals: – Introduction to python, Variables and Data Types, Comments, Input Function, Operators, Coding Standards, Integrated Development Environment(IDE) ;Control Structures: Selection Control Structures, ,Looping/Iterative Control Structures; Data Structures: String , List, Dictionary and Tuple ,Set, Functions: Built-in functions, User-defined Functions, Recursion.

OBJECT ORIENTED PROGRAMMING USING PYTHON Introduction to Object Oriented Paradigm: Abstraction and Entity, Encapsulation and Data hiding, Class and Object, Unified Modelling Language (UML), Object Oriented Approach, Class Variables, Class methods and Static Methods, Documentation, Inheritance & Polymorphism: UML: is-a relationship (Generalization), Types of Inheritance, Multiple Inheritance, Polymorphism, Benefits of OOP, Memory Management in Python, Relationships: has-a relationship: Aggregation & Composition, uses-a relationship; File handling, Exception Handling, Raising Exceptions

15 Hours

UNIT - II

RELATIONAL DATABASE MANAGEMENT SYSTEM Data and Need for DBMS: Data – Is it important, What is Data, Do we need to store data, How to Store / Handle Data, What is DBMS and its Models, Functional Needs of DBMS, Data perspectives in DBMS; Relational Model and Keys: What is RDBMS, Data representation in RDBMS, Keys in RDBMS; Database Development Life Cycle; Data Requirements; Logical Database Design: Different Approaches in Logical Design, ER Modeling, ER Notations, Steps in ER Modeling; Physical Database Design: Converting ER Model to Relational Schema ;Normalization: Functional Dependency, First Normal Form: 1NF, Second Normal Form: 2NF, Third Normal Form: 3NF, Normalization Guidelines;

Implementation with SQL: What is SQL, Data types and Operators in SQL, SQL Statements: SQL - Built-in Functions; SQL - Group by and Having Clauses Joins: Inner Join, Outer Join, Self-Join, Sub Queries: Independent Sub queries, Correlated Sub queries, Index, Views, Transactions, PL/SQL

15 Hours

UNIT - III

PYTHON DATABASE INTEGRATION Why Database Programming, Python Database Integration – Pre-requisites and Installation, SELECT Operation: Retrieve Data from Database, Attributes of Cursor object, Bind variables, CREATE and INSERT Operation: Creating a table, Insert Operation, Inserting Multiple Records, UPDATE Operation, DELETE Operation, Exception Handling.

9 Hours

Course Outcomes: At the end of the course the student will be able to:

1. Explain the basic program constructs of Python Programming.
2. Design and apply the object oriented programming construct using Python to build the real world application.
3. Summarize the concepts related to Relational Database Management System.
4. Design and develop databases from the real world by applying the concepts of Normalization using SQL and PL/SQL.
5. Perform the various Database operations by connecting Python with Database.

Table-2: Mapping Levels of COs to POs / PSOs															
COs	Program Outcomes (POs)												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	1	2	3		1				1	1		1		3	
CO2	1	2	3		1				1	1		1		3	3
CO3	1	2	3											3	
CO4	2	3												3	3
CO5	1	2	3		1				1	1		1		3	2

3: Substantial (High)

2: Moderate (Medium)

1: Poor (Low)

TEXTBOOKS:

1. Kenneth A. Lambert, “The Fundamentals of Python: First Programs, 2012”, Cengage Learning.
2. Magnus Lie Hetland, “Beginning Python from Novice to Professional”, Second Edition.
3. Mark Summerfield, Programming in Python 3 – “A Complete Introduction to the Python Language”, Second Edition.
4. Elmasri, Navathe, "Fundamentals of Database Systems", Third edition, Addison Wesley

REFERENCE BOOKS:

1. Y. Daniel Liang, “Introduction to Programming Using Python”, Pearson, ISBN:9780-13274718-9, 2013.
2. Raghu Ramakrishnan and Johannes Gehrke: “Database Management Systems” (Third Edition), McGraw-Hill, 2003.

SEE SCHEME:

There will be **8** questions of **20** marks each in the question paper divided into **3 Units** as per the syllabi & contact hours and the student will have to answer **5** full questions, selecting **2** full questions from **Unit - I & Unit – II** and **1** full question from **Unit-III**

CONSUMER ELECTRONICS			
Course Code	20EC8X18	CIE Marks	50
Teaching Hours/Week (L:T:P)	3:0:0	SEE Marks	50
Total Hours	39	Credits	03

Course Learning Objectives:

This course will enable the students to

1. Learn and design operating principles of "real world" electronic devices
2. Study broader view of key principles of electronic device's operation and presents a block circuit diagram.
3. Learn to integrate the many different aspects of emerging technologies and able to build unique mix of skills required for careers.

UNIT – I

Sound: Properties of sound and its propagation, Transducers (Micro Phone, Loud Speakers), enclosures, mono-stereo, Amplifiers, Multiplexers, mixers, Synthesizers.

Vision: B/W TV, CTV concepts, B/W & Color Cameras, Displays.

15 Hours

UNIT – II

Recording and Playback: Optical discs; recording and playback, audio and video systems, Theatre Sound, Studios, Editing.

Communications and Broadcasting: Switching Systems, Land lines, Modulation, Carrier, Fiber optics, Radio and TV broad casting

Data Services: Data services, mobiles, terrestrial & Satellite Systems, GPS, Computers, internet Services.

15 Hours

UNIT – III

Utilities: Fax, Xerox, Calculators, Microwave ovens, Washing Machines, A/C & refrigeration, Dishwashers, ATMS, Set -Top boxes, Auto Electronics, Industrial Electronics, Robotics, Electronics in health / Medicine, nano- technologies.

9 Hours

Course Outcomes:

At the end of the course the student will be able to

1. Recall basics of sound.
2. Recall basics of television and camera.
3. Explain basic working of Recording, storage devices,
4. Explain basics of communication and broadcasting.
5. Recall basic working of commonly used electronic gadgets

TEXTBOOKS:

1. Anand, "Consumer Electronics", Khanna publications, 2011.
2. Bali S. P., "Consumer Electronics", Pearson Education, 2005.

REFERENCE BOOK:

1. Gulati R. R., "Modern Television Engineering", Wiley Eastern

Scheme of SEE Question Paper

There will be **8** questions of **20** marks each in the question paper divided into **3 Units** as per the syllabi & contact hours and the student will have to answer **5** full questions, selecting **2** full questions from **Unit - I & Unit – II** and **1** full question from **Unit – III**.

OPERATIONS MANAGEMENT & ENTREPRENEURSHIP

Course code	20ME8X28	CIE Marks	50
Teaching Hours/Week (L:T:P)	(3:0:0)	SEE Marks	50
Total Hours	39	Credits	03

Course Learning Objectives: This Course will enable students to,

1	Define production/operations management, Classify Production and service system and different type of production systems, Understand the importance of CRM and ERP
2	Appreciate the importance of Quality tools and methods in operations management
3	Analyze the data draw variable process control charts and determine process capability; Understand salient issues concerning reliability
4	Understand the issues related to entrepreneurship, characteristics of an entrepreneur and different studies carried out during project appraisal.
5	Identify and differentiate the different national and state level funding agencies.

UNIT – I

Introduction to Production/ Operations Management: Concept of production, Classification of production systems, Production Management, Concept of operations, Distinction between Manufacturing Operations and Service Operations, Objectives of Operations Management (Customer Service and Resource utilization/ Competitive advantage through Quality-Delivery-Cost), Scope of Operations Management. Introduction to Customer Relationship Management (CRM) and Enterprise Resource Planning (ERP).

7 Hours

Introduction to Quality Concepts: The Meaning of Quality and Quality Improvement, Key dimensions of Quality, Concept of cost of quality. Customers' perception of quality.

TOTAL Quality Management: Definition, Principles of TQM, Gurus of TQM, Benefits of TQM.

Managing Quality: Quality circles, Continuous Improvement- Juran's Trilogy, PDSA cycle, Kaizen, 7 QC tools,

Philosophy of statistical process control and modeling process quality: Normal distribution tables, Finding the Z score, Central limit theorem, Chance and assignable causes of variation, Statistical Basis of the Control Charts (basic principles, choices of control limits, significance of control limits, warning limits)

9 Hours

UNIT – II	
<p>Control charts for variables: Control Charts for X-Bar and R- Charts, Type I and Type II errors, Simple Numerical Problems,</p> <p>Process capability: The foundation of process capability, Natural Tolerance limits, c_p – process capability index, c_{pk}, p_p – process performance index, summary of process measures. Numerical problems. Concept of Six sigma.</p> <p>Introduction to reliability, Mean time to failure, Mean time between failures, Bath tub curve, Reliability of series and parallel systems, Numerical problems on the above topics.</p> <p style="text-align: right;">8 Hours</p> <p>Entrepreneurship: Concept of Entrepreneurship, Stages in entrepreneurial process, Role of entrepreneurs in Economic Development, Barriers to Entrepreneurship, Meaning of Entrepreneur, Functions of an Entrepreneur, Types of Entrepreneurs, Intrapreneur - an emerging Class.</p> <p>Identification of business opportunities: Market Feasibility Study; Technical Feasibility Study; Financial Feasibility Study & Social Feasibility Study.</p> <p>Application of Operations Management concepts in Facility/ Business Location: General procedure for making locations decisions, Numerical Problems on application of Breakeven analysis and Transportation method to make location decisions.</p> <p style="text-align: right;">8 Hours</p>	
UNIT – III	
<p>Small scale industries: Definition; Characteristics; Need and rationale; Objectives; Scope; role of SSI in Economic Development. Advantages of SSI, Steps to start and SSI, Government policy towards SSI; Different Policies of SSI, Impact of Liberalization, Privatization, Globalization on SSI. Effect of WTO/GATT on SSI, Supporting Agencies of Government for SSI, Ancillary Industry and Tiny Industry (Definition Only)</p> <p>Institutional Support: Different Schemes; TECKSOK; KIADB; KSSIDC; KSIMC; DIC Single Window Agency; SISI; NSIC; SIDBI; KSFC.</p> <p style="text-align: right;">7 Hours</p>	

Course Outcomes (CO)

CO 1	Differentiate production and service systems. Discuss continuous and intermittent production systems with their advantages and disadvantages. Discuss CRM and ERP systems.
CO 2	Discuss Total Quality Management tools and methods. Solve problems on fundamentals of statistics and normal distribution.
CO 3	Draw and Analyze variable process control charts and determine process capability. Calculate reliability of series and parallel systems using the information on failure rate and time.
CO 4	Discuss entrepreneurship, characteristics of an entrepreneur and barriers to entrepreneurship. Discuss the elements of a project report and feasibility studies conducted in the project appraisal.
CO 5	Identify and differentiate the national and state level funding agencies. Discuss the effect of GATT and WTO on Indian economy.

TEXTBOOKS:

- Production / Operations Management**, Joseph G Monks, McGraw Hill Books
- Production and Operations Management**, William J Stevenson, Tata McGraw Hill, 8th Edition.
- Statistical Quality Control:** RC Gupta, Khanna Publishers, New Delhi, 2005.
- Total Quality Management:** Dale H. Besterfield, Pearson Education, 2003.
- Dynamics of Entrepreneurial Development & Management** – Vasant Desai – Himalaya Publishing House
- Entrepreneurship Development** – Poornima.M.Charantimath – Small Business Enterprises – Pearson Education – 2006 (2 & 4).

REFERENCE BOOKS:

- Statistical Quality Control:** E.L. Grant and R.S. Leavenworth, 7th edition, McGraw- Hill publisher.
- Statistical Process Control and Quality Improvement:** Gerald M. Smith, Pearson Prentice Hall. ISBN 0 – 13-049036-9.
- Statistical Quality Control for Manufacturing Managers:** W S Messina, Wiley & Sons, Inc. New York, 1987
- Statistical Quality Control:** Montgomery, Douglas, 5th Edition, John Wiley & Sons, Inc. 2005, Hoboken, NJ (ISBN 0-471-65631-3).
- Principles of Quality Control:** Jerry Banks, Wiley & Sons, Inc. New York.
- Entrepreneurship Development** – S.S.Khanka – S.Chand & Co.

MOOC/NPTEL Resources:

1. <http://nptel.ac.in/courses/110105067/>
2. <https://www.edx.org/course/operations-management-iimbx-om101-1x>

Course Articulation Matrix

Course Code / Name: 18ME8X28/ Operations Management & Entrepreneurship															
Course Outcomes (CO)	Program Outcomes (PO)														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
C-20ME8X28.1	3	1	0					1	1	1	1				
C-20ME8X28.2	1	2	0						1	1	3				
C-20ME8X28.3	2	2	0				1	0	1	1	3				
C-20ME8X28.4	3	1	0			1	0	1	1		2				
C-20ME8X28.5	1	1	0			1	1	1	1		3				

1: Low 2: Medium 3: High

Scheme of SEE Question Paper

There will be 8 questions of 20 marks each in the question paper divided into 3 Units as per the syllabi & contact hours and the student will have to answer 5 full questions, selecting 2 full questions from Unit - I & Unit – II and 1 full question from Unit – III.

HUMAN RESOURCE MANAGEMENT			
Course Code	20ME8X33	CIE Marks	50
Teaching Hours/Week (L:T:P)	3:0:0	SEE Marks	50
Total Hours	39	Credits	03

Course Learning Objectives:

This Course will enable students to

- 1) To develop a meaningful understanding of HRM theory, functions and practices.
- 2) To understand concepts and skills recruitment.
- 3) To understand the concepts of training and development.
- 4) To deal with employees' grievances, safety and health types of organizations.
- 5) To understand the concepts of e-HRM.

UNIT - I

Human Resource Management & HRP:

Introduction, meaning, nature, scope of HRM. Major functions of HRM, Personnel Management vs Human Resource Management, job design, job evaluation, job analysis, job specification, job enlargement, job enrichment. Role of HR Manager. HR Planning. Process HRP.

8 Hours

Recruitment: Definition, Sources and Methods of Recruitment

Selection: Definition and Process of Selection. Cost benefit analysis of selection.

Placement: Meaning, Induction/Orientation, Internal Mobility, Transfer, Promotion, Demotion and Employee Separation. Performance Appraisal methods

8 Hours

UNIT – II

Training and development: Training v/s development, stages in training, Training Methods, Executive Development, Methods and Development of Management Development, Career and Succession Planning.

Compensation: employee remuneration, rewards, Wage and Salary Administration, Bonus, fringe benefits. Internal Mobility, External Mobility, Trade union Act (Amendment) 2001.

7 Hours

Employee Grievances: Employee Grievance procedure. Discipline procedure

Collective bargaining; Characteristics, Necessity, Forms

Safety & Health; Industrial accidents, Safety

Quality circle; Meaning, Structure

8 Hours

UNIT – III	
IHRM. Managing IHRM. e-HR Activities, Global recruitment, selection, expatriates. Industrial conflict – Causes, Types, Prevention and Settlement. e-HRM; Aspects of e-HRM,e-Job design & Analysis, Ethical issues in employment	
8 Hours	
<u>Course Outcomes (CO):</u>	
At the end of the course the student will be able to:	
CO 1	Describe the basic concepts of HRM & HRP.
CO 2	Elucidate the HRM functions of recruitment, selections, appraisal etc.
CO 3	Apply the training, development and compensation methods in HRD.
CO 4	Identify the employee grievances and to spell out the remedial measures.
CO 5	Infer the concepts of e-HRM and I-HRM.
TEXTBOOK:	
1. Essentials of Human Resource Management & Industrial Relations-P Courseba Rao, Third Revised Edition	
REFERENCE BOOKS:	
1) Human Resource Management - John M. Ivancevich, 10/e, McGraw Hill.	
2) Human Resource Management-Flippo	
3) Human Resource Management - Lawrence S. Kleeman, Biztantra , 2012.	
4) Human Resource Management – Aswathappa K HPH	
MOOC/NPTEL Resources:	
1) http://edx.nimt.ac.in/courses/course-v1:nimtX+PGDM1212+2017_H1/about	
2) http://nptel.ac.in/courses/122105020/	

Course Articulation Matrix

Course Code / Name : 20ME8X33 / HUMAN RESOURCE MANAGEMENT														
Course Outcomes (CO)	Program Outcomes (PO)												PSO	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
C-20ME8X33.1	3	-	-	-	-	1	-	-	1	1	-	1	-	-
C-20ME8X33.2	3	-	-	-	-	1	-	-	1	1	-	1	-	-
C-20ME8X33.3	3	-	-	-	-	1	-	-	1	1	-	1	-	-
C-20ME8X33.4	3	-	-	-	-	1	-	-	1	1	-	1	-	-
C-20ME8X33.5	3	-	-	-	-	1	-	-	1	1	-	1	-	-

1: Low 2: Medium 3: High

Scheme of SEE Question Paper

There will be **8** questions of **20** marks each in the question paper divided into **3 Units** as per the syllabi & contact hours and the student will have to answer **5** full questions, selecting **2** full questions from **Unit - I & Unit – II** and **1** full question from **Unit – III**.

LINGUISTICS & LANGUAGE TECHNOLOGY			
Course Code	20HU8X37	Course Type	OEC
Teaching Hours/Week (L:T:P: S)	3:0:0:0	Credits	03
Total Teaching Hours	39+0+0	CIE + SEE Marks	50+50
Teaching Department: Humanities			
<u>Course Learning Objectives:</u>			
1.	Introspect about the consciousness in one's language		
2.	Learn pronunciation and how the process helps to communicate effectively.		
3.	Build contextual speech and writing with the pedagogy in sentence structure.		
4.	Improve skill of applying language to enunciate words.		
5.	Progress on the speech aspects by understanding the acquisition of Second Language.		
UNIT - I			
Introduction to Linguistics Broad understanding of Linguistics, Language and characteristic features, Scientific Language, Levels of Linguistic Analysis (Phonetics, Phonology, Morphology, Syntax and Semantics); Approach to Linguistics (Traditional, Structural and Cognitive).			8
Phonology and Morphology Perspectives in Linguistics, Phonemes, Allophones, Phonemic Analysis, Morphology and Morphemes, Word building process, Morphological Analysis.			8
UNIT - II			
Syntax Constituent structure (Simple Sentence, Noun Phrase, Verb Phrase, Prepositional Phrase, Adjective Phrase, Adverb Phrase, Structure Rules), Tree Diagrams, Case			16
UNIT – III			
Sociolinguistics & Psycholinguistics, Artificial Intelligence Notion of Language Variety, Languages in Contact, Language and Mind, Error Analysis.			7
Course Outcomes: At the end of the course student will be able to			
1.	Understand the importance of language and its facets.		
2.	Demonstrate knowledge of sounds and competence in process of word building.		
3.	Evolve to reason the constituent parts of a sentence.		
4.	Understand the techniques of how 'meaning' is applied.		
5.	Analyze errors in day-to-day-conversations and how language is related to society.		

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	1	2	3	4	5	6	7	8	9	10	11	12	PSO↓	
↓ Course Outcomes													1	2
CO1		1			1	1			1			2		
CO2			2						2	2				
CO3	2	3		3					3	2				
CO4					2				1	2				
CO5		2				2	1					1		

1: Low 2: Medium 3: High

REFERENCE MATERIALS:

1.	Akmaijan, A, R. A. Dimers and R. M. Harnish. Linguistics: An Introduction to Language and Communication. London: MIT Press, 1979.
2.	Chomsky, Noam. Language in Mind. New York: Harcourt Brace Jovanovich, 1968.
3.	Fabb, Nigel. Sentence Structure. London: Routledge, 1994.
4.	Hockett, C. A Course in Modern Linguistics. New York: Macmillan, 1955.
5.	O'Grady, W., O. M. Dobrovolsky and M. Aronoff. Contemporary Linguistics: An Introduction. New York: St. Martin's Press, 1991.
6.	Pride, J. B. and J. Holmes. Sociolinguistics. Harmondsworth: Penguin, 1972.
7.	Richards, J. C. Error Analysis: Perspectives in Second Language Acquisition. London: Longman, 1974.
8.	Salkie, R. The Chomsky Update: Linguistics and Politics. London: Unwin Hyman Ltd., 1990.
9.	Sinclair, J. M. C. H. and R. M. Coulthard. Towards an Analysis of Discourse. Oxford: OUP, 1975.
10.	Thomas, Linda. Beginning Syntax. Oxford: Blackwell, 1993.
11.	Verma, S. K. and N. Krishnaswamy. Modern Linguistics: An Introduction. New Delhi: OUP, 1989.
12.	Wekker, Herman and Liliane Haegeman. A Modern Course in English Syntax. Kent: Croom Helm, 1985.

BIOFUEL ENGINEERING			
Course Code	20BT8X40	CIE Marks	50
Teaching Hours/Week (L:T:P)	3:0:0	SEE Marks	50
Total Hours	39	Credits	03

Prerequisites: Nil

Co-requisites: Nil

Course Learning Objectives:

The objective of this course is

- To learn the fundamental concepts of biofuels, types of biofuels, their production technologies.
- To learn the concepts of feedstock utilization and energy conversion technologies.

UNIT – I

LIQUID BIOFUELS

Description and classification of Biofuels; Primary biomass: Plant materials-Woody biomass, Lignocellulosic and agroindustrial by-products, starchy and sugary crops. Secondary biomass: Waste residues and co-products-wood residues, animal waste, municipal solid waste. Biomass production for fuel – algal cultures, yeasts (Lipid and carbohydrate).

Production of biodiesel: Sources of Oils – edible and non edible; Esterification and Transesterification. Free fatty acids; saponification; Single step and two step biodiesel production. Catalysts for biodiesel production – homogeneous (alkali/acidic) and heterogeneous; Lipase mediated process. General procedure of biodiesel production and purification Quality Control Aspects: GC analysis of biodiesel, fuel property measurements, ASTM (D-6751) and Indian standards (IS15607). Algal Biodiesel production.

Production of Bioethanol: Bioethanol production using Sugar; Starch and Lignocellulosic feedstocks; Pretreatment of lignocellulosic feed stock

15 Hours

UNIT – II

BIOHYDROGEN AND MICROBIAL FUEL CELLS

Enzymes involved in H₂ Production; Photobiological H₂ Production: Biophotolysis and Photofermentation; H₂ Production by Fermentation: Biochemical Pathway, Batch Fermentation, Factors affecting H₂ production, Carbon sources, Detection and Quantification of H₂. Reactors for biohydrogen production.

Microbial Fuel cells: Biochemical Basis; Fuel Cell Design: Anode & Cathode Compartment, Microbial Cultures, Redox Mediators, Exchange Membrane, Power Density; MFC Performance Methods: Substrate & Biomass Measurements, Basic Power Calculations, MFC Performance: Power Density, Single vs Two-Chamber Designs, Wastewater Treatment Effectiveness; Advances in MFC.

15 Hours

UNIT – III

RECOVERY OF BIOLOGICAL CONVERSION PRODUCTS

Biogasification of municipal solid waste: Anaerobic processing; Types of digesters, Biogas plant in India.

Thermochemical processing: Planning an incineration facility, Incineration technologies: Mass burning system; Refuse derived fuel (RDF) system; modular incineration; Fluidized bed incineration; energy recovery; Fuel production through biomass incineration, Pyrolysis and gasification, hydrothermal processing.

9 Hours

Course Outcomes:

At the end of this course, student should be able to:

1. Mark the significance of biofuels and raw materials and Identify suitable feedstock for production of biofuels.
2. Illustrate the production of liquid biofuels from various feed stocks.
3. Demonstrate production of biohydrogen using microbial sources.
4. Extend the concepts of microbial fuel cells towards development of specific application.
5. Understand and apply the concepts of biochemical processing to harvest energy from waste products/streams.

Mapping of POs &COs:

CO	PO											
	1	2	3	4	5	6	7	8	9	10	11	12
CO1		M							L			
CO2		M							L			
CO3		M							L			
CO4		M							L			
CO5		M							L			

REFERENCE BOOKS:

1. Drapcho, C. M., Nhuan, N. P. and Walker, T. H. *Biofuels Engineering Process Technology*, Mc Graw Hill Publishers, New York, 2008.
2. Jonathan R.M, *Biofuels – Methods and Protocols (Methods in Molecular Biology Series)*, Humana Press, New York, 2009.
3. Olsson L. (Ed.), *Biofuels (Advances in Biochemical Engineering/Biotechnology Series)*, Springer-Verlag Publishers, Berlin, 2007.
4. Glazer, A. and Nikaido, H. *Microbial Biotechnology – Fundamentals of Applied Microbiology*, 2 Ed., Cambridge University Press, 2007.
5. Godfrey Boyle (Ed). *Renewable Energy- Power for sustainable future*, 3rd Ed. Oxford. 2012.
6. Ramachandran, T. V. *Management of municipal solid waste*. Environmental Engineering Series. Teri Press, 2016.

SEE QUESTION PAPER PATTERN:

Unit No.	I	II	III
Questions to ask (20 marks/Qn)	3	3	2
Questions to answer	2	2	1

NUMBER THEORY			
Course Code	20MA8X43	CIE Marks	50
Teaching Hours/Week (L:T:P)	3:0:0	SEE Marks	50
Total Hours	39	Credits	03

Course Learning Objectives:

1.	Understand the divisibility of integers ,study of prime numbers and basic properties of congruences.
2.	Study Fermat's little theorem and understand Euler's function.
3.	Study the existence of primitive roots and quadratic residues.
4.	Study the cryptographic applications in number theory.

UNIT - I

Divisibility and the theory of congruences

Division algorithm, Euclid's algorithm for the greatest common divisor. Linear Diophantine equations. Prime numbers, fundamental theorem of arithmetic. Basic properties of congruences, Linear congruences and Chinese remainder theorem.

15 Hours

UNIT - II

Fermat's theorem, Wilson's theorem, Euler's Phi function, Euler's theorem.

Primitive roots and Quadratic congruences

16 Hours

Order of an integer modulo n, primitive roots for primes, Euler's criterion, Legendre symbol and its properties

UNIT - III

Cryptography

Introduction to public key cryptography, RSA cryptosystem, an application of primitive roots to cryptography

8 Hours

Course Outcomes: At the end of the course student will be able to

1.	Use divisibility and Greatest common divisor in Euclidean algorithm. Solve Diophantine equations. Identify prime factorization of an integers.
2.	Understand the properties of congruences. Use Chinese remainder theorem to find solution of system of linear congruences
3.	Use Fermat's Little Theorem and Wilson's Theorem. Use of Euler's Phi function.
4.	Identify primitive roots of an integers. Apply Euler's criterion and Legendre symbols.
5.	Code and decode numbers in the RSA cryptosystem.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes →	1	2	3	4	5	6	7	8	9	10	11	12
↓ Course Outcomes												
CO1	2	3										
CO2	2	3										
CO3	2	3										
CO4	2	3										
CO5	2	3										

1: Low 2: Medium 3: High

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The student must obtain minimum of 40% marks individually both in CIE and SEE to pass. Theory Semester End Exam (SEE) is conducted for 100 marks (3 Hours duration). Based on this grading will be awarded.

Continuous Internal Evaluation:

1.	Methods recommended: Two Tests (80%), Written Quiz (10%) and module assignments (10%).
2.	The class teacher must decide the topic for closed book test and Written Quiz. In the beginning only teacher must announce the methods of CIE for the subject.

Semester End Examination:	
	There will be 8 questions of 20 marks each in the question paper categorized into 3 Units as per the syllabi & contact hours. The student will have to answer 5 full questions, selecting 2 full questions each from Unit - I & Unit – II and 1 full question from Unit – III .

TEXTBOOKS:	
1.	D. Burton; Elementary Number Theory, McGraw-Hill, 2005
2.	Niven, H.S. Zuckerman & H.L. Montgomery, Introduction to the Theory of Numbers, Wiley, 2000.

REFERENCE BOOKS:	
1.	H. Davenport, The Higher Arithmetic, Cambridge University Press, 2008.
2.	G.A. Jones & J.M. Jones, Elementary Number Theory, Springer UTM, 2007.
3.	Thomas Koshy, Elementary Number Theory with Applications, 2nd edition, Elsevier, 2007
4.	Fundamentals of Number Theory by William J. LeVeque

E Books / MOOCs/ NPTEL	
1.	http://refkol.ro/matek/mathbooks/ro.math.wikia.com%2520wiki%2520Fisiere_pdf_incarcate/Elementary-Number-Theory.pdf
2.	https://nptel.ac.in/courses/111104138
3.	https://nptel.ac.in/courses/111103020

AUTOMOTIVE ENGINEERING			
Course Code	20ME8X65	CIE Marks	50
Teaching Hours/Week (L:T:P)	3:0:0	SEE Marks	50
Total Hours	39	Credits	03

Course Learning Objectives:	
This Course will enable students to,	
1	Get an idea on the different components of an engine and its types with lubrication system.
2	Understand the fuel supply system and ignition systems used in automobiles.
3	Demonstrate the working of transmission system.
4	Explain the importance of suspension system, steering geometry and drives in automobiles
5	Know the concept of braking system, tyres and emission control.

UNIT – I

ENGINE COMPONENTS AND COOLING & LUBRICATION SYSTEMS:

SI & CI engines, Cylinder-arrangements and their relative merits, Liners, Piston, connecting rod, crankshaft, valves, valve actuating mechanisms, valve and port timing diagrams, Choice of materials for different engine components, engine positioning, cooling requirements, methods of cooling, thermostat valves, different lubrication arrangements, crankshaft/flywheel position sensor, accelerator pedal sensors, engine coolant water temperature sensor.

8 Hours

FUEL SUPPLY SYSTEMS FOR SI AND CI ENGINES: Fuel mixture requirements for SI engines, types of carburetors, simple carburetor, multi point and single point fuel injection systems, CRDI, fuel transfer pumps: AC Mechanical Pump, SU Electrical Pumps, injectors, Fuel gauge sensor, Throttle position sensor, Mass air flow sensors.

5 Hours

IGNITION SYSTEMS:

Battery Ignition systems, magneto Ignition system, Transistor assisted contacts. Electronic Ignition, Automatic

Ignition advance systems, Lighting systems, Rain/Light sensors, starting device (Bendix drive)	2 Hours
UNIT – II	
POWER TRAINS: Clutches- Single plate, multiplate and centrifugal clutches. Gear box: Necessity for gear ratios in transmission, Constant mesh gear box, Synchromesh gear box, principle of automatic transmission, Vehicle Speed Sensors, calculation of gear ratios, Types of transmission systems. No numerical.	8 Hours
DRIVE TO WHEELS: Propeller shaft, universal joints, Hotchkiss. and torque tube drives, differential, rear axle, steering geometry, camber, king pin inclination, included angle, castor, toe-in & toe-out, condition for exact steering, power steering, over steer, under steer & neutral steer, Steering angle sensors, numerical problems.	5 Hours
SUSPENSION AND SPRINGS: Requirements, leaf spring, coil spring, Torsion bar suspension systems, independent suspension for front Wheel, Air suspension system.	2 Hours
UNIT – III	
BRAKES: Types of brakes, mechanical, compressed air, vacuum and hydraulic braking systems, construction and working of master and wheel cylinder, brake shoe arrangements, Disk brakes, Drum brakes.	5 Hours
TYRES Desirable tyre properties, Types of tyres.	1 Hour
AUTOMOTIVE EMISSION: Automotive exhaust emissions, sources and emission control method: EGR, SCR, Emission Standards, Exhaust sensors. Electric Vehicles.	3 Hours

Course Outcomes (CO):

At the end of the course the student will be able to

CO 1	Describe and demonstrate the layout of an automobile and components of an automobile engine. Explain cooling and lubrication systems.
CO 2	Explain and demonstrate the fuel supply and Ignition systems for SI and CI engines.
CO 3	Describe and demonstrate the transmission system
CO 4	Explain and demonstrate the components of drive to wheel and suspension system, calculate the parameters of steering geometry.
CO 5	Describe and demonstrate automotive braking system. Explain types and construction of tyres and wheels. Explain the significance of automotive emissions and its controlling methods.

TEXTBOOKS:

1. Automotive Mechanics by S. Srinivasan, Tata McGraw Hill, 2003
2. Automobile Engineering, Kirpal Singh, Vol I and II, 2013.
3. Automotive Electrical and Electronics, A. K. Babu, Khanna Publishers, 2nd edition, 2016

REFERENCE BOOKS :

1. Automobile Engineering, R. B. Gupta, Satya Prakashan, 4th Edn., 1984 .
2. Automobile Engineering, Narang, Khanna Publishers 2002
3. Automotive Mechanics, Crouse, McGraw Hill 2002
4. Automotive Mechanics, Joseph Heithner 2000
5. Automobile Mechanics by N. K. Giri, Khanna publishers 2002
6. Newton and Steeds Motor Vehicle, Butterworth, 2nd Edn. 1989.
7. Automobile Engineering by K. K. Jain and R. B_ Arshana, Tata McGraw Hill, 2002
8. Automobile Mechanics, A.K. Babu & S.C. Sharma, T.R. Banga, Khanna Book Publishing
9. A Textbook of Automobile Engineering, R.K. Rajput, Laxmi Publications

List of proposed Experiments in Automotive Laboratory:**4 Hours**

1. Study of Automotive - Chassis & superstructure/body and its functions. Also involves study of cut section of wheel & tyres (bias and radial types).
2. Study of more commonly used tools and equipment in automotive shop.
3. Study of carburetors and petrol & diesel fuel injection systems
4. Demonstration and study of Front axle and steering system
5. Demonstration and study of various suspension systems
6. Power train - Dismantling and assembly of single/multi cylinder Engine.
7. Power train - Study of clutch mechanism. Demonstration and study of dry friction clutches - Single plate & multi-plate types
8. Power train - Demonstration and study of transmission system - Gear box
9. Power train - Demonstration and study of Universal joints, propeller shaft, final drives, differential, and rear axles
10. Demonstration and study of brake mechanism (hydraulic type) and study of disc and drum brakes
11. Field visit to Automotive Servicing Station - Study of electrical system, wheel alignment (measuring and adjustment of castor, camber, king-pin inclination, toe-in and toe-out), automotive emission control systems.

(The details of each experiment to be given out as handout to each student or may be uploaded in Intranet)

Course Articulation Matrix:

Course Code / Name: 20ME8X65 / Automotive Engineering														
Course Outcomes (CO)	Program Outcomes (PO)												PSO	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
C-20ME8X65.1	3	1	-	-	-	1	-	-	3	1	-	1	3	3
C-20ME8X65.2	3	1	-	-	-	1	-	-	3	1	-	1	1	3
C-20ME8X65.3	3	1	1	-	-	1	-	-	3	1	-	1	3	3
C-20ME8X65.4	2	3	1	-	-	1	-	-	3	1	-	1	2	3
C-20ME8X65.5	3	1	1	-	-	1	1	1	3	1	-	1	2	3

1: Low 2: Medium 3: High

Scheme of SEE Question Paper

There will be **8** questions of **20** marks each in the question paper divided into **3 Units** as per the syllabi & contact hours and the student will have to answer **5** full questions, selecting **2** full questions from **Unit - I & Unit - II** and **1** full question from **Unit - III**.

DISASTER MANAGEMENT			
Course Code	20CV8X67	CIE Marks	50
Teaching Hours/Week (L:T:P)	3:0:0	SEE Marks	50
Total Hours	39	Credits	03

Course Learning Objectives:

1. Understand difference between Disaster, Hazard, Vulnerability, and Risk.
2. Know the Types, Trends, Causes, Consequences and Control of Disasters
2. Apprehend Disaster Management Cycle and Framework.
3. Know the Disaster Management in India
4. Appreciate Applications of Science and Technology for Disaster Management.

UNIT – I

Understanding Disasters: Understanding the Concepts and definitions of Disaster, Hazard, Vulnerability, Risk, Capacity – Disaster and Development, and disaster management.

Types, Trends, Causes, Consequences and Control of Disasters: Geological Disasters (earthquakes, landslides, tsunami, mining); Hydro-Meteorological Disasters (floods, cyclones, lightning, thunder-storms, hail storms, avalanches, droughts, cold and heat waves) Biological Disasters (epidemics, pest attacks, forest fire); Technological Disasters (chemical, industrial, radiological, nuclear) and Manmade Disasters (building collapse, rural and urban fire, road and rail accidents, nuclear, radiological, chemicals and biological disasters) Global Disaster Trends – Emerging Risks of Disasters – Climate Change and Urban Disasters

15 Hours

UNIT – II

Disaster Management Cycle and Framework: Disaster Management Cycle – Paradigm Shift in Disaster Management Pre-Disaster – Risk Assessment and Analysis, Risk Mapping, zonation and Microzonation, Prevention and Mitigation of Disasters, Early Warning System; Preparedness, Capacity Development; Awareness During Disaster – Evacuation – Disaster Communication – Search and Rescue – Emergency Operation Centre – Incident Command System – Relief and Rehabilitation – Post-disaster – Damage and Needs Assessment, Restoration of Critical Infrastructure – Early Recovery – Reconstruction and Redevelopment; IDNDR, Yokohama Strategy, Hyogo Framework of Action

Disaster Management in India: Disaster Profile of India – Mega Disasters of India and Lessons Learnt, Disaster Management Act 2005 – Institutional and Financial Mechanism National Policy on Disaster Management, National Guidelines and Plans on Disaster Management; Role of Government (local, state and national), Non-Government and Inter-Governmental Agencies

15 Hours

UNIT – III

Applications of Science and Technology for Disaster Management: Geo-informatics in Disaster Management (RS, GIS, GPS and RS) Disaster Communication System (Early Warning and Its Dissemination) Land Use Planning and Development Regulations Disaster Safe Designs and Constructions Structural and Non Structural Mitigation of Disasters S&T Institutions for Disaster Management in India

Case Studies: Study of Recent Disasters (at local, state and national level)

Preparation of Disaster Risk Management Plan of an Area or Sector,

Role of Engineers in Disaster Management

Hours

Course Outcomes:

After completion of this course the students will be able to

1. **Explain** Concepts, Types, Trends, Causes of Disasters
2. **Describe** Consequences and Control of Disasters
3. **Explain** Disaster Management Cycle and Framework:
4. **Explain** the lesson learnt from the disasters in India and **discuss** the financial mechanism, roles and responsibilities of Non-Government and Inter-Governmental Agencies for Disaster management
5. **Describe** the Applications of Science and Technology recent disasters, role of engineers for Disaster Management and **prepare** a report of Disaster Risk Management Plan.

Mapping of POs & COs:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1						3	2				1	2			
CO2						3	2				1	2			
CO3						3	2				1	2			
CO4						3	2				1	2			
CO5						3	2				1	2			

Note:1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

REFERENCE BOOKS:

1. Coppola D P, 2007. Introduction to International Disaster Management, Elsevier Science (B/H), London.
2. <https://nidm.gov.in/PDF/pubs/DM%20in%20India.pdf>, Disaster Management in India, MHA, 2011.
3. World Disasters Report, 2018. International Federation of Red Cross and Red Crescent, Switzerland
4. Encyclopedia of disaster management, Vol I, II and III Disaster management policy and administration, S L Goyal, Deep & Deep, New Delhi, 2006
5. Encyclopedia of Disasters – Environmental Catastrophes and Human Tragedies, Vol. 1 & 2, Angus M. Gunn, Greenwood Press, 2008
6. Disasters in India Studies of grim reality, AnuKapur& others, 2005, 283 pages, Rawat Publishers, Jaipur.
7. Management of Natural Disasters in developing countries, H.N. Srivastava & G.D. Gupta, Daya Publishers, Delhi, 2006, 201 pages
8. Natural Disasters, David Alexander, Kluwer Academic London, 1999, 632 pages
9. Disaster Management Act 2005, Publisher by Govt. of India
10. Publications of National Disaster Management Authority (NDMA) on Various Templates and Guidelines for Disaster Management, <https://ndma.gov.in/en/publications.html#>
11. NIDM Publications <https://nidm.gov.in/books.asp>
12. High Power Committee Report, 2001, J.C. Pant
13. Disaster Mitigation in Asia & Pacific, Asian Development Bank
14. National Disaster Management Policy, 2009, GoI
15. Disaster Preparedness Kit, 2017, American Red Cross, <http://pchs.psd202.org/documents/mopsal/1539703875.pdf>.
16. Subramanian R., “Disaster Management”, 2018 Vikas Publishing House Pvt Ltd.

Note: There will be 8 questions of 20 marks each in the question paper divided into 3 Units as per the syllabi & contact hours and the student will have to answer 5 full questions, selecting 2 full questions from Unit - I & Unit – II and 1 full question from Unit – III.

INTRODUCTION TO YOGA															
Course Code:		20HU8X68			Course Type				OEC						
Teaching Hours/Week (L:T:P: S)		3:0:0:0			Credits				03						
Total Teaching Hours		39			CIE + SEE Marks				50+50						
Teaching Department: Mechanical Engineering															
Course Learning Objectives:															
1.	To give a brief history of the development of Yoga														
2.	Identify names of different classical texts on Yoga														
3.	To illustrate how Yoga is important for healthy living														
4.	To explain the Asanas and other Yogic practices														
5.	To explain, how Yoga practices can be applied for overall improvement														
UNIT – I															
Yoga: Meaning and initiation, definitions and basis of yoga, History and development, Astanga yoga, Streams of yoga. Yogic practices for healthy living. General guidelines for Yoga practices for the beginners: Asanas, Pranayama.											09 Hours				
Classification of Yoga and Yogic texts:Yogasutra of Patanjali, Hatha yogic practices- Asanas, Pranayama, Dharana, Mudras and bandhas.											07 Hours				
UNIT – II															
Yoga and Health: Concept of health and Diseases-Yogic concept of body – pancakosaviveka, Concept of disease according to Yoga Vasistha.											06 Hours				
Yogic concept of healthy living- rules & regulations, yogic diet, ahara, vihara. Yogic concept of holistic health.											04 Hours				
Applied Yoga for elementary education:Personality development- physical level,mental level,emotional level. Specific guidelines and Yoga practices for - Concentration development,Memory development											04 Hours				
UNIT - III															
Yoga and physical development: Mind-body, Meditation, Yogasanas and their types. Different Yoga practices and Benefits.											05 Hours				
Specific guidelines and Yoga practices for – Flexibility, Stamina, Endurance (Surya Namaskara)											04 Hours				
Course Outcomes: At the end of the course student will be able to															
1.	Understand a brief history of the development of Yoga														
2.	Know important practices and principles of Yoga														
3.	Explain how Yoga is important for healthy living														
4.	Practice meditation to improvement of concentration etc.														
5.	Have knowledge about specific guidelines of yoga practices														
Course Outcomes Mapping with Program Outcomes & PSO															
Program Outcomes→		1	2	3	4	5	6	7	8	9	10	11	12	PSO↓	
↓ Course Outcomes														1	2
CO1							1			1			1		
CO2							1			1			3		
CO3							2			1			3		
CO4							3			2			3		
CO5							2			2			3		
1: Low 2: Medium 3: High															

TEXTBOOKS:	
1.	B.K.S. Iyengar, “Light on Yoga: The Classic Guide to Yoga by the World’s Foremost Authority”, Thorsons publisher 2016.
2.	MakarandMadhukar Gore, “Anatomy and Physiology of Yogic Practices: Understanding of the Yogic Concepts and Physiological Mechanism of the Yogic Practices”, MotilalBanarsidass Publishers; 6 edition (2016).
3.	Swami SatyanandaSaraswati, “Asana, Pranayama, Mudra and Bandha: 1”, Yoga Publications Trust.
REFERENCE BOOKS:	
1.	Science of Yoga: Understand the Anatomy and Physiology to Perfect Your Practice by Ann Swanson
2.	Yoga for Everyone : 50 Poses For Every Type of Body by Dianne Bondy
E Books / MOOCs/ NPTEL	
1.	https://onlinecourses.swayam2.ac.in/aic19_ed29/preview
2.	https://youtu.be/FMf3bPS5wDs

INTRODUCTION TO JAPANESE LANGUAGE			
Course Code	20HU8X72	Course Type	OEC
Teaching Hours/Week (L:T:P: S)	3:0:0:0	Credits	03
Total Teaching Hours	39+0+0	CIE + SEE Marks	50+50
Teaching Department:			
Course Objectives:			
1.	Have basic spoken communication skills		
2.	Write Simple Sentences		
3.	Listen and comprehend basic Japanese spoken Japanese		
4.	Read and understand basic Japanese characters including Kanji		

UNIT - I															
(Lessons 1-6) Grammar – Introduction, Alphabets, Accents, Noun, Pronoun, Present Tense, Past tense Vocabulary – Numbers, Days, week days, months, Seasons, Nature, Dialogs and Video Clips													13		
UNIT - II															
(Lessons 7-13) Communication skills – Time, Adjective, Seasons, Conversation, Q&A Hobby, 5-W/1-H, Entering School/Company, Body Parts, Colours, Features etc.													13		
UNIT - III															
(Lessons 14-20) Japanese Counting System, Birth/Death, Dialogs (Going to Party, Restaurant), My day, Success/Failure, Kanji Characters, and sentence making, Video Clips													13		
Course Outcomes: At the end of the course student will be able to															
1.	Understand Simple words, expressions and sentences, spoken slowly and distinctly														
2.	Speak slowly and distinctly to comprehend														
3.	Read and Understand common words and sentences														
4.	Ask Basic questions and speak in simple sentences														
5.	Write Hiragana/Katakana and Kanji (120) characters.														
Course Outcomes Mapping with Program Outcomes & PSO															
	Program Outcomes→	1	2	3	4	5	6	7	8	9	10	11	12	PSO↓	
	↓ Course Outcomes													1	2
	CO1						3			2	1		1		
	CO2						3			2	1		1		
	CO3						3			2	1		1		
	CO4						3			2	1		1		
	CO5						3			2	1		1		
1: Low 2: Medium 3: High															

INTRODUCTION TO GERMAN LANGUAGE			
Course Code	20HU8X74	Course Type	OEC
Teaching Hours/Week (L:T:P: S)	3:0:0:0	Credits	03
Total Teaching Hours	39+0+0	CIE + SEE Marks	50+50
Teaching Department: Mechanical			
Course Objectives:			
1.	Distinguish - definite and indefinite articles, declension of singular and plural nouns by adding certain endings to them to differentiate between subjects, objects and indirect objects and construct sentences of simple day to day usage.		
2.	Differentiate between nominative and accusative cases with transitive and intransitive verbs, and negation with Kein/e/er		
3.	Differentiate use of dative object besides the subject for some specific verbs and Apply the grammar principles of use of personal pronoun as a substitute for noun as per the case, number and gender of the noun.		
4.	Differentiate preposition forms when used exclusively in accusative or Dative forms or on combination of the two cases		
5.	Differentiate conjugation of verbs in present, present-perfect and past participle tenses, separable and inseparable verbs, application of conjugation of modal verbs and position of modal verb in a sentence.		

UNIT - I

Introduction: Mein Name ist (saying who you are, greeting people and saying goodbye, asking people where they come from and where they live. Language point: I and you), Lesen der politischen Karte der Welt, Nationalitäten und Sprachen, Die Uhrzeit (The time) telling time and talking about daily routine, Tage der Woche, die Monate, die vier Jahreszeiten, die Jahre
Mir gehtes gut: Asking people how they are, saying how you are, saying which cities and countries people come from, Language points: verb endings),
Wieschreibt man das (how do you write that?) Counting from 1-100 and above, alphabet, spelling our names and words, talking about us and them. Language points: Yes-no questions

Artikel (Articles): As in English, there are definite (der/die/das) and indefinite (ein/eine) articles:
the □ der/die/das; a/an □ ein/eine

Die vier Fälle (The four cases): Nominativ, Akkusativ, Dativ, Genitiv (Not in level A-1)

Deklination des bestimmten Artikels der/die/das

Deklination des unbestimmten Artikels ein/eine

(Deklination/Declension: the variation of the form of a noun, pronoun, or adjective, by which its grammatical case, number, and gender are identified)

Deklination von Substantiven (Declension of nouns) (Singular and Plural)

(German nouns are declined by attaching certain endings to them, according to case, number and gender. This helps to differentiate between subjects, objects and indirect objects).

Nominativ und Akkusativ (nominative and accusative cases)

The verb determines the case of the noun. Some verbs only go with the nominative, others only with the accusative (or the dative). Thus, German verbs are either transitive or intransitive.

(Nominative and accusative cases) Intransitive Verben (intransitive verbs) Transitive Verben (transitive verbs)

Negation „kein/e/er“ (negation with „kein/e/er“)

(Singular und Plural)

The negation of the indefinite article (ein/eine/ein) is kein/keine/kein. For this, you just have to put a „k“ at the beginning of the declined form of ein/eine/ein.

Peter sieht ein Haus. □ Negation □ Peter sieht kein Haus.

(Peter sees a house. □ negation □ Peter does not see a house.)

(With examples, writing and hearing exercises, and German to English Glossary as applicable)

13

UNIT - II

Dativ (the dative)

(You are already familiar with verbs which require a direct accusative object in addition to the subject, which is in the nominative case. But there also some verbs which require a dative object besides the subject. To identify the dative object you ask “(To) whom?”)

Der Plural (the plural)

There are many different forms of the plural in the German language. Principally, the gender and the ending of the noun determine the plural form. Then, you either attach a plural ending to the noun, change a vowel, or keep the noun as it is in the singular.

Das Personalpronomen (the personal pronoun)

The personal pronoun is a substitute for a noun. Its forms are determined by the case, number and gender of the noun which is to be replaced.

Die Formen des Personalpronomen im Nominativ

(The nominative forms of the personal pronoun):

Präpositionen (prepositions)

German prepositions are followed by an object, either in the accusative or the dative case. Some prepositions always take an accusative object, others always a dative object. But there are also prepositions which can be followed by both. In this case, the question “Where(to)?”

(□ accusative) or “Where?” (□ dative) determines the case of the object.

Präpositionen mit Akkusativ und Dativ

(Prepositions with accusative and dative)

1. Präpositionen mit Akkusativ (prepositions with accusative)

2. Präpositionen mit Dativ (prepositions with dative)

3. Präpositionen mit Akkusativ oder Dativ (prepositions with accusative or dative)

13

(With examples, writing and hearing exercises, and German to English Glossary as applicable)

UNIT - III

Konjugation von Verben im Präsens
(Conjugation of verbs in present tense)
Verbs are conjugated by attaching certain endings, depending on the person and number of the subject.

Trennbare und untrennbare Verben
(separable and inseparable verbs)
Verbs with prefixes are distinguished between separable and inseparable verbs.
The prefix of an inseparable verb must never be separated from the stem. Here the stress is on the stem: bekommen. The prefix of a separable verb gets separated from the stem when the verb is conjugated. In the infinitive, the stress is on the prefix: an-kommen
1. Trennbare Verben (separable verbs)
2. Untrennbare Verben (inseparable verbs)

Konjugation von Verben im Perfekt
(Conjugation of verbs in present perfect)
The present perfect (Perfekt) describes something which happened in the past and is especially used in spoken German. It is formed with the present tense form of „haben“ or „sein“ and the past participle of the main verb.
1. Die Bildung des Partizips
(the formation of the past participle)
2. Die Bildung des Perfekts mit „haben“ und „sein“
(the formation of the present perfect with „haben“ and „sein“)

Modalverben (modal verbs)
A modal verb is rarely used as a main verb; instead, it usually modifies the main verb. While the main verb remains in the infinitive, the modal verb is conjugated.
In German, there are 7 modal verbs:
können (can/be able), dürfen (may/be allowed), wollen (want),
müssen (must/have to), sollen (shall), mögen (to like), möchten (wish/would like)
1. Konjugation der Modalverben
(Conjugation of the modal verbs)
2. Stellung des Modalverbs im Satz
(Position of the modal verb within a sentence)

(With examples, writing and hearing exercises, and German to English Glossary as applicable)

Course Outcomes: At the end of the course student will be able to

1.	Distinguish - definite and indefinite articles, declension of singular and plural nouns by adding certain endings to them to differentiate between subjects, objects and indirect objects and construct sentences of simple day to day usage.
2.	Differentiate between nominative and accusative cases with transitive and intransitive verbs, and negation with <i>Kein/e/er</i>
3.	Differentiate use of dative object besides the subject for some specific verbs and Apply the grammar principles of use of personal pronoun as a substitute for noun as per the case, number and gender of the noun.
4.	Differentiate preposition forms when used exclusively in accusative or Dative forms or on combination of the two cases
5.	Differentiate conjugation of verbs in present, present-perfect and past participle tenses, separable and inseparable verbs, application of conjugation of modal verbs and position of modal verb in a sentence.

Course Outcomes Mapping with Program Outcomes & PSO														
Program Outcomes→	1	2	3	4	5	6	7	8	9	10	11	12	PSO↓	
	↓ Course Outcomes												1	2
HU1502-1.1						3			2	1		1		
HU1502-1.2						3			2	1		1		
HU1502-1.3						3			2	1		1		
HU1502-1.4						3			2	1		1		
HU1502-1.5						3			2	1		1		
1: Low 2: Medium 3: High														
TEXTBOOKS:														
1.	Ulrich Haessermann, Georg Dietrich, Christianne C. Guenther, Diethelm Kaminski, Ulrike Woods and Hugo Zenker, Sprachkurs Deutsch Neusaffung 1, Unterrichtswerk fuer Erwachsene, Verlag Moritz Diesterweg, Universitaetsdruckerei H. Stuert AG Wuerzburg, 1989													
2.	Paul Coggle and Heiner Schenke, Teach Yourself German (a complete course in understanding, speaking and writing), Teach Yourself Books, Hodden & Stoughton Educational, UK, 2001													
3.	Langenscheidt German In 30 Days: Book + Cd Paperback, www.amazon.in, – 1 September 2011													
REFERENCE MATERIALS:														
1.	Deutsche Sprachlehre fuer Auslaender.													
2.	Themen Aktuell (Text and workbook).													
3.	Deutsch als Fremdsprache 1A.													
4.	Tangram Aktuell 1A/1B (Text and workbook).													
5.	Wherever required the Videos/Audios are also played in the class room sessions													
E-RESOURCES:														
1.	https://onlinecourses.nptel.ac.in/noc21_hs30/preview NPTEL-Swayam, German-I by Prof. Milind Brahma IIT Madras													
2.	https://www.traingerman.com/en/ powered by Sprachinstitut TREFFPUNKT Online													

SUSTAINABLE DEVELOPMENT GOALS			
Course code	20ME8X75	CIE Marks	50
Teaching Hours/Week (L:T:P)	3:0:0	SEE Marks	50
Total Hours	39	Credits	03
Course Learning Objectives:			
Sustainable Development Goals is a 2016 United Nations officially released Agendas for Sustainable approach environmental integrity, economic viability and a just society for present and future generations. It aims to provide the knowledge, skills, attitudes and values necessary to address sustainable development challenges. They address the global challenges we face, including poverty, inequality, climate change, environmental degradation, peace and justice. Learn more and take action. This SDG program is organized in such a way to be research-led, applied interdisciplinary program that considers sustainability in both developed and developing societies, and addresses critical global challenges put forth by UN.			
UNIT – I			
The origin, development and idea of the SDGs			
History and origins of the Sustainable Development Goals. What are the SDGs? What are their aims, methodology and perspectives? How are they related to the Millennium Development Goals?			
SDGs and Society: Ensuring resilience and primary needs in society			
In-depth discussion and analysis of goals related to poverty, hunger, health & well-being and education			
13 Hours			
UNIT – II			
SDGs and Society: Strengthening Institutions for Sustainability			
In-depth discussion and analysis of goals related to gender equality, affordable and clean energy, sustainable cities & communities, and peace, justice & strong institutions			

<p>SDGs and the Economy: Shaping a Sustainable Economy In-depth discussion and analysis of goals related to work & economic growth, industry, innovation & infrastructure, inequalities, responsible production & consumption</p> <p style="text-align: right;">13 Hours</p>
UNIT – III
<p>SDGs and the Biosphere: Development within Planetary Boundaries In-depth discussion and analysis of goals related to clean water, climate, life below water and life on land Realizing the SDGs: Implementation through Global Partnerships In-depth discussion and analysis of SDG 17 which aims to implement the SDGs through partnerships, finance, technology and the development of coherence between policies.</p> <p style="text-align: right;">13 Hours</p>

Course Outcomes:

At the end of the course the student will be able to

CO 1	Summarize the UN’s Sustainable Development Goals and how their aims, methodology and perspectives.
CO 2	Analyze the major issues affecting sustainable development and how sustainable development can be achieved in practice.
CO 3	Identify and apply methods for assessing the achievement/possibilities of sustainable development in Nitte gram panchayath.
CO 4	Evaluate the implications of overuse of resources, population growth and economic growth and sustainability & Explore the challenges the society faces in making transition to renewable resource use
CO 5	Create skills that will enable students to understand attitudes on individuals, society and their role regarding causes and solutions in the field of sustainable development.

TEXTBOOKS:

1. Sachs, Jeffrey D. The age of sustainable development. Columbia University Press, 2015
2. Gagnon, B., Leduc, R., and Savard, L., Sustainable development in engineering: a review of principles and definition of a conceptual framework. Cahier de recherche / Working Paper 08-18, 2008.
3. Dalby, Simon, et al. Achieving the Sustainable Development Goals: Global Governance Challenges. Routledge, 2019.
4. Sustainability: A Comprehensive Foundation by Tom Thesis and JonathanTomkin, Editors.

REFERENCE BOOKS:

1. Elliott, Jennifer. An introduction to sustainable development. Routledge, 2012.
2. Day, G.S., and P.J.H. Schoemaker (2011), Innovating in uncertain markets: 10 lessons for green technologies, MIT Sloan Management Review, 52.4: 37-45.

MOOC Resources:

1. <https://www.un.org/sustainabledevelopment/poverty/>

Course Articulation Matrix

Course Code / Name : 20ME/ SUSTAINABLE DEVELOPMENT GOALS														
Course Outcomes (CO)	Program Outcomes (PO)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1	2	1	1	1	3	3	1	1	1		2	1	1
2	2	2	1	1	1	3	3	2	1	1		1	1	1
3	3	2	2	1	1	3	3	2	3	1		1	1	2
4	3	2	3	1	1	3	3	2	1	1		1	3	2
5	1	2	2	1	1	3	3	2	2	2		1	1	1

1: Low 2: Medium 3: High

Scheme of SEE Question Paper

There will be **8** questions of **20** marks each in the question paper divided into **3 Units** as per the syllabi & contact hours and the student will have to answer **5** full questions, selecting **2** full questions from **Unit - I & Unit – II** and **1** full question from **Unit – III**.

INTERNET OF THINGS – (IoT)			
Course Code	20CS8X80	CIE Marks	50
Teaching Hours/Week (L:T:P)	3:0:0	SEE Marks	50
Total Hours	39	Credits	03

Course Learning Objectives:

This Course will enable students to:

1. Learn the IoT Definitions, Design aspects
2. Identify the IoT hardware and software requirements
3. Describe IoT logical and physical design concepts
4. Implement Arduino based IoT Projects
5. Implement Raspberry Pi based IoT Projects

UNIT – I

Introduction

Introduction to IoT : Definition and characteristics, Physical design, Logical design, Enabling technologies, Levels and deployment templates, Examples: Domain specific IoTs, IoT Design and System Engineering, Discuss IoT Requirements, Hardware & Software; Study of IoT sensors, Tagging and Tracking, Embedded Products; IoT Design, (U) SIM Card Technology, IoT Connectivity and Management, IoT Security & IoT Communication.

(Text Book-1:, Chapter 1 to 4)

15 Hours

UNIT – II

Design Concepts:

IoT Logical Design:

Data types, Data structures, Control flow, Functions, Modules, Packages, File Handling, Date and time operation, Classes, Python packages of IoT, IoT Physical Design, Basic building blocks, Raspberry Pi, Linux on Raspberry Pi, Interfaces, Programming on Raspberry Pi with Python, Arduino Based IoT Project Implementation, Arduino for Project development, Internet enabled Arduino powered garage door opener, Irrigation control system, Light controller Message, controller and cloud Services

(Text Book-1: Chapter 4,5,6 ,7)

15 Hours

UNIT – III

09 Hours

Raspberry Pi based IoT Project Implementation:

Raspberry Pi for Project Development: Raspberry Pi platform, GPIO, Establishment and setting, of Raspberry Pi software, LAMP project, Home temperature, monitoring system, Webcam and Raspberry Pi camera project (Text Book-1: Chapter 10,11,12, 13)

Course Outcomes:

At the end of the course the student will be able to:

1. Acquire the fundamental knowledge of IoT Definitions, Design aspects
2. Identify the IoT hardware and software requirements
3. Design IoT logical and physical architecture
4. Implement Arduino based IoT Projects
5. Implement Raspberry Pi based IoT Projects

Table-2: Mapping Levels of COs to POs / PSOs															
COs	Program Outcomes (POs)												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	1						1	1			1		3	
CO2	2	3						1	1			1		3	
CO3	3	1						1	1			1		3	
CO4	3	2			3			1	1			1	1	3	3
CO5	3	2			3			1	1			1	1	3	3

3: Substantial (High)

2: Moderate (Medium)

1: Poor (Low)

TEXTBOOKS:

1. Arshdeep Bahga, Vijay Madiseti, "Internet of Things: A Hands-On Approach, Vijay Madiseti", 2014.
2. Donald Norris, "The Internet of Things: Do-It-Yourself at Home Projects for Arduino, Raspberry Pi and BeagleBone Black", 1st Edition, McGraw Hill, 2015.

REFERENCE BOOKS:

1. Dr. SRN Reddy, Rachit Thukral and Manasi Mishra, "Introduction to Internet of Things: A practical Approach", ETI Labs
2. Pethuru Raj and Anupama C. Raman, "The Internet of Things: Enabling Technologies, Platforms, and Use Cases", CRC Press
3. Jeeva Jose, "Internet of Things", Khanna Publishing House, Delhi
4. Adrian McEwen, "Designing the Internet of Things", Wiley
5. Raj Kamal, "Internet of Things: Architecture and Design", McGraw Hill
6. Cuno Pfister, "Getting Started with the Internet of Things", O Reilly Media

E-Books / Online Resources:

1. Object-Oriented Analysis and Design with Applications, Grady Booch, Robert A. Maksimchuk, Michael W. Engel, Bobbi J. Young, Jim Conallen, Kelli A. Houston, Third Edition The Addison-Wesley Object Technology Series, 2007
2. Object-Oriented Modelling and Design with UML, James R Rumbaugh, Michael R. Blaha Pearson Education, 21-Nov-2011
3. Object-Oriented Analysis and Design, Ramnath, Sarnath, Dathan, Brahma, ISBN 978-1-84996-522-4,, Springer Publications, 2011.

MOOC:

1. <https://www.coursera.org/specializations/internet-of-things>
2. <https://www.udemy.com/course/iot-internet-of-things-automation-using-raspberry-pi/>
3. <https://www.udemy.com/course/arduino-iot-cloud/>

SEE SCHEME:

There will be **8** questions of **20** marks each in the question paper divided into **3 Units** as per the syllabi & contact hours and the student will have to answer **5** full questions, selecting **2** full questions from **Unit - I & Unit – II** and **1** full question from **Unit – III**.

SOFTWARE ENGINEERING PRACTICES			
Course Code	20IS8X83	CIE Marks	50
Teaching Hours/Week (L:T:P)	3:0:0	SEE Marks	50
Total Hours	39	Credits	03

Course Learning Objectives:

This Course will enable students:

1. Outline software engineering principles and activities involved in building large software programs.
2. Explain the importance of architectural decisions in designing the software.
3. Describe the process of Agile project development.
4. Recognize the importance of software testing and describe the intricacies involved in software evolution.
5. Identify several project planning and estimation techniques and explain the importance of software quality.

UNIT – I

Introduction: Need for Software Engineering, Professional Software Development, Software Engineering Ethics, Case Studies.

Software Processes: Models: Waterfall Model, Incremental Model and Spiral Model; Process activities.

Requirements Engineering: Functional and non-functional requirements, Requirements engineering processes, Requirements Elicitation and Analysis, Requirements specification, Software requirements document, Requirements validation & management.

15 Hours

UNIT – II

System Models: Context models, Interaction models, Structural models, Behavioral models.

T Architectural Design: Architectural design decisions. Architectural Views and patterns, Application architectures.

Design and implementation: Object oriented Design using UML.

Agile Software Development: Agile methods, Plan-driven and agile development, Extreme Programming, Agile project management.

15 Hours

UNIT – III

Project Management: Risk management, Teamwork.

Project Planning: Software pricing, Plan-driven development, Project Scheduling

Quality Management: Software quality, Reviews and inspections, Software measurement and metrics, Software standards.

9 Hours

Course Outcomes:

Students will be able to:

Sl. No.	Course Outcomes
1.	Recognise the basics of software system, component, process and Software Requirement Specification to meet desired needs within realistic constraints and outline the professional and ethical responsibility
2.	Describe the waterfall, incremental and iterative models and architectural design in implementing the software
3.	Make use of the techniques, skills, modern engineering design tools and agile methods necessary for engineering practice.
4.	Describe the methods for maintaining software system.
5.	Discuss project planning and management and illustrate the quality of software products

Program Outcomes→	1	2	3	4	5	6	7	8	9	10	11	12	PSO↓	
↓ Course Outcomes													1	2
IS2504-1.1		3	1					2					1	2
IS2504-1.2	1	3	1										1	2
IS2504-1.3	1	1	3										2	3
IS2504-1.4	1	3	2										1	2
IS2504-1.5	1	2	2										1	2

1: Low 2: Medium 3: High

TEXTBOOK:

1. Ian Sommerville, “Software Engineering”, 9th Edition, Pearson Education, 2012. 82Syllabus of III & IV Semester B.E. / Computer Science &Engg.

REFERENCE BOOKS:

1. Roger S. Pressman: “Software Engineering-A Practitioners approach”, 7th Edition, Tata McGraw Hill, 2017.
2. Pankaj Jalote: “An Integrated Approach to Software Engineering”, Wiley, India, 2010.

E-RESOURCES

1. <http://agilemanifesto.org/>
2. <http://www.jamesshore.com/Agile-Book/>
3. <https://www.mooc-list.com/course/uml-class-diagrams-software-engineering-edx>
4. <https://www.mooc-list.com/course/enterprise-software-lifecycle-management-edx>

SEE Question Paper Pattern:

There will be **8** questions of **20** marks each in the question paper divided into **3 Units** as per the syllabi & contact hours and the student will have to answer **5** full questions, selecting **2** full questions from **Unit-I & Unit – II** and **1** full question from **Unit– III**.

INTRODUCTION TO CYBER SECURITY			
Course Code	20IS8X84	CIE Marks	50
Teaching Hours/Week (L:T:P)	3:0:0:0	SEE Marks	50
Total Hours	39	Credits	03

Course Learning Objectives:

This Course will enable students:

1. Define the area of cybercrime and forensics.
2. Explain the motive and causes for cybercrime, detection and handling.
3. Investigate Areas affected by cybercrime.
4. Illustrate tools used in cyber forensic

UNIT – I

Introduction to Cybercrime: Cybercrime- Definition and Origins of the Word, Cybercrime and Information Security, Who are Cybercriminals? Classifications of Cyber Crimes. [T1: 1.1-1.5]

Cyberoffenses: How Criminals Plan Them: How Criminals Plan the Attacks, Social Engineering, Cyberstalking, Cybercafe and Cybercrimes, Botnets: The Fuel for Cybercrime, Attack Vector, Cloud Computing. [T1: 2.1-2.8].

Mobile and Wireless Devices: Introduction, Proliferation of Mobile and Wireless Devices, Trends in Mobility, Credit Card Frauds in Mobile and Wireless Computing Era, Security Challenges Posed by Mobile Devices, Registry Settings for Mobile Devices, Authentication Service Security, Attacks on Mobile/Cell Phones, Mobile Devices: Security Implications for organizations, Organizational Measures for Handling Mobile, Organizational Security Policies and Measures in Mobile Computing Era, Laptops. [T1:3.1-3.12]

14 Hours

UNIT – II

Tools and methods used in Cybercrime:

Introduction, Proxy Servers and Anonymizers, Phishing, Password Cracking, Keyloggers and Spywares, Virus and Worms, Trojan-horses and Backdoors, Steganography, DoS and DDoS Attacks, SQL Injection, Buffer Overflow, Attacks on Wireless Networks. [T1: 4.1-4.12]

Phishing and Identity Theft Introduction to Phishing, Identity Theft (ID Theft). [T1: 5.1-5.3]

12 Hours

UNIT – III

UNDERSTANDING COMPUTER FORENSICS

Introduction, Digital Forensics Science, The Need for Computer Forensics, Cyberforensics and Digital Evidence, Forensics Analysis of E-Mail, Digital Forensics Life Cycle, Chain of Custody Concept, Network Forensics, Approaching a Computer Forensics Investigation, Setting up a Computer Forensics Laboratory: Understanding the Requirements, Computer Forensics and Steganography, Relevance of the OSI 7 Layer Model to Computer Forensics, Forensics and Social Networking Sites: The Security/Privacy Threats, Computer Forensics from Compliance Perspective, Challenges in Computer Forensics, Special Tools and Techniques, Forensics Auditing, Antiforensics. [T1: 7.1-7.19]

13 Hours

Course Outcomes:

Students will be able to:

Sl. No.	Course Outcome
IS2503.1	Comprehend the Cybercrime and its origin
IS2503.2	Analyse the cybercrimes in mobile and wireless devices
IS2503.3	Apply tools and methods used in Cyber crimes
IS2503.4	Analyse Phishing and and ID Theft
IS2503.5	Comprehend Digital Forensics

Program Outcomes→ ↓ Course Outcomes	1	2	3	4	5	6	7	8	9	10	11	12	PSO↓	
													1	2
IS2503-1.1	2					1		3						
IS2503-1.2		3		1		2			2					
IS2503-1.3		3	2										2	3
IS2503-1.4	2					2								
IS2503-1.5								3						

(L/1 = Low 30%-49%, M/2 = Medium 50%-69%, H/3=High >70%)

TEXTBOOKS:

1. SunitBelapure and Nina Godbole, "Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives", Wiley India Pvt Ltd, ISBN: 978-81-265-21791, Publish Date 2013.

REFERENCE BOOKS:

1. Thomas J. Mowbray, "Cyber security: Managing Systems, Conducting Testing, and Investigating Intrusions", Copyright © 2014 by John Wiley & Sons, Inc, ISBN: 978 -1-118 -84965 -1.
2. James Graham, Ryan Olson, Rick Howard, "Cyber Security Essentials", CRC Press, 15-Dec 2010. Anti-Hacker Tool Kit (Indian Edition) by Mike Shema, Publication Mc Graw-Hill.

SEE Question Paper Pattern:

There will be **8** questions of **20** marks each in the question paper divided into **3 Units** as per the syllabi & contact hours and the student will have to answer **5** full questions, selecting **2** full questions from **Unit-I & Unit – II** and **1** full question from **Unit– III**.

SPACE TECHNOLOGY AND APPLICATIONS			
Course Code	20EC8X85	CIE Marks	50
Teaching Hours/Week (L:T:P)	3:0:0	SEE Marks	50
Total Hours	39	Credits	03

Course Learning Objectives:

This Course will enable students to

1. Understand the general laws governing satellite orbits and its parameters.
2. Discuss effect of space environment on satellite signal propagation.
3. Illustrate various segments employed in satellite and ground station.
4. Calculate the uplink/downlink sub system characteristics.
5. Know the effects on the EM waves in propagation through space.
6. Explain the satellite launch in the space and their applications in remote sensing.
7. Discuss the different communication systems used for satellite access.
8. Summarise Advanced space systems for mobile communication, VSAT, GPS.

UNIT – I

Satellite communications: Introduction, Kepler's laws, definitions, orbital element, apogee and perigee heights, orbit perturbations, inclined orbits.

Space environment: Earth's Atmosphere, Ionosphere and Meteorological effects on space systems, propagation of signal, Transmission losses in space environment.

Satellite Technology: Space segment, Ground segment, Quality and Reliability, Satellite Communication systems, Antennas.

15 Hours

UNIT – II

Launch Vehicles: Working, stages, Fuel, payload protection, Navigation, guidance and control, Reliability, launching into outer space and launch bases. Types of launch vehicles.

Space Applications: Digital DBS TV, DBS-TV System Design, Master Control Station and Uplink Antennas. Introduction, Radio and Satellite Navigation,

Remote Sensing: Introduction to Remote Sensing, Concepts and Applications of satellite Remote sensing.

14 Hours

UNIT – III

Satellite Access: Introduction, Single Access, Pre-assigned FDMA, Demand-Assigned FDMA, Spade system.

Advanced space systems: Satellite mobile services, VSAT, Radarsat, orbital communication. Global Positioning Satellite System (GPS).

10 Hours

Course Outcomes:

At the end of the course student will be able to

1. Discuss the fundamental principles of Satellite communication systems.
2. Discuss the Propagation impairments of satellite link.
3. Explain various segments employed in satellite and ground station.
4. Discuss the satellite launch mechanism and roll of those satellite in remote sensing.
5. Explain the different communication systems used for satellite access and list the recent satellites that have been launched for mobile communication, GPS.

Course Outcomes:

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

High Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The student must obtain minimum of 20 marks out of 50 in CIE and 20 marks out of 50 in SEE and 40% in total to obtain a pass grade. Semester End Exam (SEE) is conducted for 100 marks (3 Hours duration). Based on this grading will be awarded.

Continuous Internal Evaluation:

1. **Methods recommended:** Two Tests (80%), Written Quiz (16%) and module assignments (4%). Course coordinator will announce the evaluation procedure at the beginning of the semester and will be recorded in the course plan.

Semester End Examination:

1. There will be 8 questions of 20 marks each in the question paper categorized into 3 Units as per the syllabi & contact hours. The student will have to answer 5 full questions, selecting 2 full questions each from Unit- I& Unit-II and 1 full question from Unit- III.

TEXTBOOKS:

- T1. Dennis Roddy, “**Satellite Communications**”, McGraw Hill 1996.
T2. Timothy Pratt, “**Satellite Communications**”, Wiley India Ltd, 2006.
T3. K Ramamurthy, “**Rocket Propulsion**”, McMillan Publishers India Ltd, 2010.

REFERENCE BOOKS:

- R1. George Joseph, “**Fundamentals of Remote Sensing**”, Universities press, India 2003.
R2. BC Pande, “**Remote sensing and Applications**”, VIVA Books Pvt Ltd, 2009.
R3. Meynart Roland, “**Sensors systems and next generation satellites**”, SPIE Publication.
R4. Thyagarajan, “**Space Environment**”, ISRO Hand Book Publication.

E-Books / MOOC:

<https://nptel.ac.in/courses/101106046>

MARKETING MANAGEMENT			
Course Code	20ME8X88	CIE Marks	50
Teaching Hours/Week (L:T:P)	3:0:0	SEE Marks	50
Total Hours	39	Credits	03

Course Learning Objectives:

This Course will enable students to

1. Understand and learn the marketing concepts and their application to profit-oriented and non-profit oriented organizations.
2. Able to apply the marketing concepts to analyze the buying behavior & marketing segments to solve these problems.
3. Understand and learn the need for a customer orientation in product pricing & marketing research in the competitive global business environment;
4. Able to develop an understanding and acquiring skills in how to successfully design and implement marketing plans and strategies.
5. Understand and learn the concept of sales, advertising & distribution of marketing mix and its application in traditional and novel environments characterized by emerging information technologies.

UNIT - I

BASICS

Definition, Marketing Process, Dynamics, Needs, Wants & Demands, Marketing Concepts, Environment, mix, types, philosophies, Selling Vs. Marketing, organization, Industrial Vs. Consumer Marketing, Consumer goods, Industrial goods, Product hierarchy.

8 Hours

BUYING BEHAVIOUR & MARKET SEGMENTATION

Cultural, Demographic factors, Motives, types, Buying decisions, segmentation factors, Demographic, Psychographic & Geographic Segmentation, Process, Patterns.

8 Hours

UNIT - II

PRODUCT PRICING & MARKETING RESEARCH

Objectives, pricing, Decisions and Pricing methods, Pricing Management. Introduction, Uses, process of Marketing Research.

8 Hours

MARKETING PLANNING & STRATEGY FORMULATION

Components of a marketing plan, strategy formulations and the marketing process, implementation, Portfolio analysis, BCG, GEC grids.

8 Hours

UNIT - III

ADVERTISING, SALES PROMOTION & DISTRIBUTION

Characteristics, Impact, goals, types, Sales promotion-Point of Purchase, Unique Selling proposition.

Characteristics, Wholesaling, Retailing, channel design, logistics, Modern Trends in retailing.

7 Hours

Course Outcomes (CO):

At the end of the course the student will be able to

CO1	Explain the basic marketing concepts
CO2	Interpret the buying behaviour of customers and role of marketing segments
CO3	Explain the role of product pricing and marketing research in the competitive global business environment
CO4	Analyse the marketing plans and strategies.
CO5	Explain the role of sales, advertising and distribution in marketing to achieve the goals of marketing

TEXTBOOK:

1. Govindarajan. M. 'Modern Marketing Management', Narosa Publishing House, New Delhi, 1999

REFERENCE BOOKS:

1. Philip Kotler, " Marketing Management: Analysis, Planning, Implementation and Control ", 1998.
2. Green Paul.E. and Donald Tull, " Research for Marketing
3. Ramaswamy.V.S. and S.Namakumari, " Decisions ", 1975.
4. Jean Plerre Jannet Hubert D Hennessey Global Marketing, Environment: Planning, Implementation and Control the Indian Context ", 1990

NEXT GENERATION WIRELESS NETWORKS

Course Code	21CC8X94	CIE Marks	50
Number of Contact Hours/Week	3:0:0	SEE Marks	50
Total Number of Contact Hours	39	Exam Hours	03
Credits – 3			
UNIT - I			Contact Hours
Historical Trend for Wireless Communication- Mobile Communications Generations: 1G to 4G – Evolution of LTE Technology to Beyond 4G – Pillars of 5G – Standardization Activities -Use cases and Requirements – System Concept 5G Architecture: Software Defined Networking – Network Function Virtualization – Basics about RAN Architecture –High-Level Requirements for 5G Architecture – Functional Architecture and 5G Flexibility – Physical Architecture and 5G Deployment.			15
UNIT - II			
Massive Multiple-Input Multiple –Output Systems : MIMO in LTE – Single-user MIMO – Multi-user MIMO – Capacity of Massive MIMO – Pilot Design of Massive MIMO. D2DCommunications: from4Gto5G–Radio Resource Management for Mobile Broadband D2D–Multi-hop D2D Communications for Proximity and Emergency Services – Multi-operator D2D Communication.			15
UNIT – III			
Wi-Fi 6 Protocol and Network: Introduction Wi-Fi Generations 1 to 5 Overview Wi-Fi Generation 6 (802.11ax) Wi-Fi6 and 5G 60 GHz Wi-Fi , Introduction to 6G and Networks			9
Course Outcomes: Upon completion of this course, students will be able to: 1.Describe and explain the evolution of 5G, system concepts and spectrum challenges 2.Illustrate and explain the 5G functional and physical architecture and its requirements 3 Illustrate and explain the fundamentals, resource allocation and transceiver algorithms for Massive MIMO 4.Describe and explain the requirements and fundamental techniques for D2DCommunication 5. Understand, Implement, explain the Wi-Fi 6 Protocol and Network			
TEXTBOOKS: <ul style="list-style-type: none"> • Asif Oseiran, JoseF. Monserratand Patrick Marsch, “5GMobile and Wireless Communications Technology,”Cambridge University Press,2016 • Jonathan Rodriquez, “Fundamentalsof5GMobileNetworks,” Wiley, 2015 Sundar Gandhi Sankaran, Susinder Rajan Gulasekaran, Wi-Fi 6 Protocol and Network, Artech House, 2021			
REFERENCE BOOK: <ul style="list-style-type: none"> • Patrick Marsch, Omer Bulakci, Olav Queseth and Mauro Boldi, “5G System Design – Architectural and Functional Considerations and Long Term Research”, Wiley, 2018 			

INTRODUCTION TO ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

Course Code	21AI8X95	CIE Marks	50
Number of Contact Hours/Week	3:0:0	SEE Marks	50
Total Number of Contact Hours	40	Exam Hours	03

Credits – 3

Course Learning Objectives:

This Course will enable students to:

1. Understand the history of AI and machine learning.
2. Learn principles and algorithms of supervised learning.
3. Explain various applications of Techniques in association analysis.
4. Use different unsupervised learning techniques to solve the problem specification.
5. Understand the methods of parametric and non-parametric methods on real time data analysis and combined learners.

UNIT – I	Hours
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<p>Introduction to AI: what is AI, Acting Humanly: The Turing Test approach, Thinking Humanly: The cognitive modelling approach, thinking rationally: The laws of thought approach, Acting Rationally: The rational agent approach. The state of art</p> <p>Branches Of Artificial Intelligence: Machine Learning, Deep Learning, Natural Language Processing, Robotics, Expert Systems, Fuzzy Logic.</p> <p>Intelligent Agents: Agents and Environments, Good behavior: The concept of rationality, The nature of environments, properties of task environments, Structure of Agents: Agent Programs, Types of agent programs.</p> <p>Solving Problems by Searching: Problem solving Agents, well defined problems and solutions, formulating problems, Example problems: Toy problems: Vacuum world, 8-Queen’s problem, Real world problem: Airline Route finding problem</p> <p>Textbook 1: Chapter 1, 2 ,3</p> <p>Foundations of Machine Learning</p> <p>What is machine learning? Applications of Machine learning, Understand Data. Types of machine learning: Supervised, Unsupervised, Reinforcement Learning.</p> <p>Supervised Learning:</p> <p>Linear Regression: Introduction, univariate linear regression, multivariate linear regression, regularized regression, Logistic regression, Support Vector Machines.</p> <p>Artificial Neural Networks.</p> <p>Textbook: Chapter 1 , 2.</p> <p>Classification: Preliminaries; General approach to solving a classification problem; Confusion Matrix, Decision tree induction, how decision tree works, Hunt’s algorithm, Design issues, Methods for expressing attribute test conditions, Measures for selecting best fit, Algorithm for decision tree induction; Rule-based classifier: How rule-based classifier works, Rule ordering schemes, Nearest-neighbor classifier: Selecting K value, KNN algorithm.</p> <p>Textbook 3: Chapter 4, 5</p> <p>Tutorials:</p> <ol style="list-style-type: none"> 1. Handling the missing values using orange tool. 2. Visualize: Scatter Plot (for univariate), Scatter Plot Matrix (for multivariate) using orange tool. 3. iris classification using different algorithm. 	15
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UNIT - II	
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<p>Unsupervised Learning:</p> <p>Association Analysis–1: Problem definition, Frequent item set generation, Apriori principle, Candidate generation and pruning, Rule Generation in Apriori algorithm.</p> <p>Association Analysis – 2: FP-Growth algorithm, Evaluation of association patterns, Effect of skewed support distribution, Sequential patterns.</p> <p>Cluster Analysis: Different types of clustering: Hierarchical vs partitional, Exclusive vs overlapping, Fuzzy clustering, Complete vs partial. Types of clusters: Well separated, Prototype based clusters, Graph based clusters, Density based clusters, Conceptual clusters, K-means clustering algorithm, centroids and objective functions, Choosing initial centroids, time space complexity of K-means, K-means additional issues, Strengths and weakness of k-means, Agglomerative hierarchical clustering,</p>	15
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<p>Key issues in hierarchical clustering, Strengths and weaknesses, DBSCAN algorithm. Textbook 3: Chapter 6, 7, 8, 9. Tutorials:</p> <ol style="list-style-type: none"> 1. Diabetes classification using orange tool. 2. Association analysis using orange tool. 3. Trying different evaluation matrix using orange tool. 	
UNIT – III	
<p>Parametric Methods: Introduction, Maximum Likelihood Estimation, Bernoulli Density, Multinomial Density, Gaussian (Normal) Density, Evaluating an Estimator: Bias and Variance, The Bayes' Estimator, Parametric Classification Nonparametric Methods: Introduction, Nonparametric Density Estimation, Histogram Estimator, Kernel Estimator, k-Nearest Neighbor Estimator, Generalization to Multivariate Data, Nonparametric Classification, Condensed Nearest Neighbor. Textbook 2: Chapter 4, 8.</p>	10
<p>Course Outcomes: Upon completion of this course, students will be able to:</p> <ol style="list-style-type: none"> 1. Basics of AI, branches of AI and ML. 2. Develop an appreciation for what is involved in learning models from supervised learning and algorithms on classification. 3. Apply association analysis on structured data. 4. Apply different unsupervised learning techniques to solve the problem specification. 5. Interpret methods of parametric and non-parametric methods on real time data analysis and know the combined learning. 	
<p>TEXTBOOKS:</p> <ol style="list-style-type: none"> 1. Stuart Russel and Peter Norvig, "Artificial Intelligence A Modern Approach", Pearson 3rd Edition, 2016. 2. Introduction to Data Mining-Pang-NingTan, Michael Steinbach,Vipin Kumar, Pearson Education, 2009. 3. Ethem Alpaydin, Introduction to Machine Learning, Second Edition, 2004. 	
<p>REFERENCE BOOKS:</p> <ol style="list-style-type: none"> 1. T. M. Mitchell, "Machine Learning", McGraw Hill, 1997. 2. R. O. Duda, P. E. Hart and D. G. Stork Pattern Classification, Wiley Publications, 2001 3. T. Hastie, R. Tibshirani, J. Friedman. The Elements of Statistical Learning, 2e, 2008. 4. P. Flach, "Machine Learning: The art and science of algorithms that make sense of data", Cambridge University Press, 2012. 5. K. P. Murphy, "Machine Learning: A probabilistic perspective", MIT Press, 2012. 6. M. Mohri, A. Rostamizadeh, and A. Talwalkar, "Foundations of Machine Learning", MIT Press, 2012. 7. S. Russel and P. Norvig, "Artificial Intelligence: A Modern Approach", Third Edition, Prentice Hall, 2009. 	

