Scheme – 2023

Department of Mechanical Engineering

G. Pulla Reddy Engineering College (Autonomous): Kurnool

Accredited by NBA of AICTE and NAAC of UGC

Affiliated to JNTUA, Anantapuramu

Scheme and Syllabus for

B.Tech in Mechanical Engineering

(With Effect from the Batch Admitted in 2023-24)

MECHANICAL ENGINEERING
FOUR YEAR B.TECH. DEGREE COURSE
SCHEME OF INSTRUCTION AND EXAMINATION

VII Semester   **Scheme 2023**

S. No.	Category	Title	L/D	T	P	Credits	CIA	End Exam Marks	Total Marks
1	PC	AI & ML for Mechanical Engineering	3	0	0	3	30	70	100
2	BS&H	Management Elective	2	0	0	2	30	70	100
3	PE	Professional Elective-IV	3	0	0	3	30	70	100
4	PE	Professional Elective-V	3	0	0	3	30	70	100
5	OE	Open Elective -III	3	0	0	3	30	70	100
6	OE	Open Elective -IV	3	0	0	3	30	70	100
7	SEC	3D Printing & Drone Technology Lab	0	1	2	2	30	70	100
8	AC	Gender Sensitization	2	0	0	0	-	-	-
9		Evaluation of Industry Internship	-	-	-	2	100		100
		Total	**19**	**1**	**2**	**21**			

VIII Semester   **Scheme 2023**

S. No.	Category	Title	L/D	T	P	Credits	CIA	End Exam Marks	Total Marks
1	PR	Internship	-	-	8	4	100		100
2	PR	Project	-	-	16	8	30	70	100
		Total			**24**	**12**			

Category:

L/D	:	Lecture/Design/Drawing	T/P	:	Tutorial / Practical	PC	:	Professional Core
CIA	:	Continuous Internal Assessment	PE	:	Professional Elective	OE	:	Open Elective
SEC	:	Skill Enhancement Course	BS&H	:	Basic Sciences & Humanities	AC	:	Audit Course
PR	:	Project/Internship						

AI & ML FOR MECHANICAL ENGINEERING (AMME)							
VI Semester: Mechanical Engineering							**Scheme: 2023**
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
ME401	**PC**	**L**	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exam**	**TOTAL**
		3	**0**	**0**	**3**	**30**	**70**	**100**
Sessional Exam Duration: 2 Hrs					**End Exam Duration: 3 Hrs**			

Course Outcomes: At the end of the course, students will be able to	
CO1:	Understand AI basics, its impacts, and intelligent agent behavior in environments.
CO2:	Examine problem-solving approaches and apply uninformed search strategies to various tasks.
CO3:	Apply informed search strategies using heuristic functions for efficient problem-solving.
CO4:	Implement basic machine learning concepts and build simple linear regression models for predictive analysis.
CO5:	Apply classification techniques using logistic regression, decision trees, and K-NN for predictive modeling.

UNIT – I

Introduction to AI: What Is AI?, Risk and benefits of AI.

Intelligent Agents: Agents and Environments, Good Behavior: The Concept of Rationality, The Nature of Environments and the Structure of Agents.

UNIT – II

Solving Problems by Searching: Problem-Solving Agents, Example Problems, Searching for Solutions.

Uninformed Search Strategies: BFS, DFS, Depth –limited search, IDA, Bidirectional search.

UNIT – III

Informed (Heuristic) Search Strategies: Greedy best-first search, A* search, Memory-bounded heuristic search, Learning to search better. Heuristic Functions.

UNIT – IV

Introduction To Machine Learning: Introduction to Analytics and Machine Learning, Why Machine Learning? Framework for Developing Machine Learning Models.

Linear Regression: Simple Linear Regression, Steps in Building a Regression Model, Building Simple Linear Regression Model.

UNIT – V

Classification Problems: Classification Overview, Binary Logistic Regression, Credit Classification, Gain Chart and Lift Chart, Decision Tree Classification, K-Nearest Neighbour Classifier.

Text Books:

1. Russell Stuart and Peter Norvig, Artificial intelligence: a modern approach, Pearson, New Delhi.
2. Manaranjan Pradhan and U Dinesh Kumar, Machine Learning using Python, Wiley, New Delhi.

Reference Books:

1. Andreas C Muller and Sarah Guido, Introduction to Machine learning with python, O'Reilly, CA.
2. Saroj Kaushik, Artificial Intelligence, Cengage Learning India, Noida.
3. Elaine Rich and Kevin Knight, Artificial Intelligence, Tata McGraw Hill, New Delhi.

4. Ethem Alpaydin, Introduction to Machine Learning, The MIT Press, Cambridge.
Online Resources:
1. https://nptel.ac.in/courses/113104517   **2.** https://nptel.ac.in/courses/127104664   **3.** https://nptel.ac.in/courses/110104164   **4.** https://nptel.ac.in/courses/106106226
Question Paper Pattern:
Sessional Exam: The question paper for Sessional Examination shall be for 40 marks. The question paper shall consist of Four questions and all questions are compulsory. Question No.1 shall contain Five compulsory short answer questions for a total of Ten marks. Question No.2 to 4 shall be EITHER/OR Type for Ten marks each. Student shall Answer any one of them. Each of these questions may contain sub-questions.   **End Examination:** The question paper for End Examination shall be for 70 marks. The Question paper shall contain Six Questions and all questions are compulsory. Question No.1 shall contain Ten compulsory short answer questions for a total of Twenty marks (with Two short answer questions from each unit). Question No.2 to 6 shall be EITHER/OR Type for Ten marks each and shall cover one Unit of the Syllabus for each question. Student shall Answer any one of them. Each of these questions may contain sub-questions.

3D PRINTING AND DRONE TECHNOLOGY LAB (3DPD (P))

VII Semester: Mechanical Engineering							Scheme: 2023	
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
SCME03	**SEC**	**L**	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exam**	**TOTAL**
		0	**1**	**2**	**2**	**30**	**70**	**100**

End Exam Duration: 3 Hrs

Course Outcomes: At the end of the course, students will be able to	
CO1:	Develop 3D CAD models and convert them into STL files suitable for additive manufacturing.
CO2:	Generate G-code and operate 3D printers and fabricating the component
CO3:	Perform post-processing operations and evaluate printed parts for surface finish, dimensional accuracy, and application suitability.
CO4:	Apply reverse engineering techniques by using 3D scanning to model and reproduce real-life components with unknown dimensions.
CO5:	Apply drone technology principles to fabricate and operate basic functional drones

LIST OF EXPERIMENTS

1.	Modeling creative designs using CAD software and Generating STL files
2.	Processing the CAD data using open source software and generating g-code.
3.	Repairing STL file using MESHMIXER
4.	Processing the tool path data and fabricating the physical part on FDM machine.
5.	Removing the supports & post processing (cleaning the surfaces).
6.	Evaluating the quality of the fabricated part in terms of surface finish and dimensional accuracy.
7.	Evaluating the fabricated part for its suitability to a given application.
8.	Producing a simple component on SLA printer.
9.	Demonstration of parts and functions of a drone.
10.	Build a prototype drone to record videos and photos.
11.	Make a drone for a certain payload.
12.	Assembling and testing a basic desktop 3D printer. (demo).
13.	Modeling of component using 3D Scanner of real life object of unknown dimension in reverse engineering and Printing. (demo).

Note: Student has to perform at least 10 experiments from the above lists

Virtual lab:

1.	https://3dp-dei.vlabs.ac.in/List%20of%20experiments.html
2.	https://ars-nitk.vlabs.ac.in/exp/volume-estimation/simulation.html
3.	https://virtual-labs.github.io/exp-assembling-of-software-based-components-of-drone-iitd/simulation.html

GENDER SENSITIZATION (GS)							
VII Semester: **Common for all Branches**							**Scheme: 2023**
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
AC401	AC	L	T	P	C	**Continuous Internal Assessment**	**End Exam**	**TOTAL**
		2	0	0	0			

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

CO1:	Understand the basic concepts of gender and its related terminology
CO2:	Identify the biological, sociological, psychological and legal aspects of gender.
CO3:	Use the knowledge in understanding how gender discrimination operates in our society andhow to counter it.
CO4:	Analyze the gendered division of labour and its relation to politics and economics
CO5:	Appraise how the various mass/ electronic and print media perpetuate gender stereotypes of men and women to the detriment of the well-being of society.

UNIT – I

Understanding Gender: Introduction, Definition of Gender-Basic Gender Concepts and Terminology-Exploring Attitudes towards Gender-Construction of Gender-Socialization: Making Women, Making Men - Preparing for Womanhood. Growing up Male. First lessons in Caste.

UNIT – II

Gender Roles and Relations: Two or Many? -Struggles with Discrimination-Gender Roles and Relations-Types of Gender Roles- Gender Roles and Relationships Matrix-Missing Women-Sex Selection and its Consequences- Declining Sex Ratio- Demographic Consequences-Gender Spectrum

UNIT – III

Gender and Labour: Division and Valuation of Labour-Housework: The Invisible Labor-—My Mother doesn't Work. —Share the Load.-Work: Its Politics and Economics -Fact and Fiction- Unrecognized and Unaccounted work -Gender Development Issues-Gender, Governance and Sustainable Development-Gender and Human Rights-Gender and Mainstreaming

UNIT – IV

Gender-Based Violence: The Concept of Violence- Types of Gender-based Violence-Gender-based Violence from a Human Rights Perspective-Sexual Harassment - Domestic Violence - Different forms of violence against women - Causes of violence, impact of violence against women - Consequences of gender-based violence

UNIT – V

Gender and Culture: Gender and Film-Gender and Electronic Media-Gender and Advertisement-Gender and Popular Literature- Gender Development Issues-Gender Issues-Gender Sensitive Language- Just Relationships

Text Books:

1. A.Suneetha, Uma Bhrugubanda, et al. Towards a World of Equals: A Bilingual Textbook on Gender, Telugu Akademi, Telangana,
2. Butler, Judith. Gender Trouble: Feminism and the Subversion of Identity. UK Paperback Edn.

Reference Books:

1. Wtatt, Robin and Massood, Nazia, Broken Mirrors: The dowry Problems in India, London : Sage Publications

2.	Datt, R. and Kornberg, J.(eds), Women in Developing Countries, Assessing Strategies for Empowerment, London: Lynne Rienner Publishers
3.	Brush, Lisa D., Gender and Governance, New Delhi, Rawat Publication,
4.	Singh, Direeti, Women and Politics World Wide, New Delhi, Axis Publications
5.	Raj Pal Singh, Anupama Sihag, Gender Sensitization: Issues and Challenges (English, Hardcover), Raj Publications
6.	A.Revathy& Murali, Nandini, A Life in Trans Activism(Lakshmi Narayan Tripathi). The University of Chicago Press
Online Resources:	
1.	https://onlinecourses.swayam2.ac.in/nou24_hs53/preview
2.	https://www.plannedparenthood.org/learn/gender-identity/sex-gender-identity/what-are-gender-roles-and-stereotypes
3.	https://www.verywellmind.com/understanding-gender-roles-and-their-effect-on-our-relationships-7499408
4.	https://www.economicsobservatory.com/what-explains-the-gender-division-of-labour-and-how-can-it-be-redressed
5.	https://eige.europa.eu/gender-based-violence/what-is-gender-based-violence?language_content_entity=en
6.	https://archive.nptel.ac.in/courses/109/106/109106136/
7.	https://gender.study/psychology-of-gender/culture-impact-gender-roles-identities/

PROJECT WORK (PW)								
VIII Semester: Mechanical Engineering								**Scheme: 2023**
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
ME402	**PR**	**L**	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exam**	**TOTAL**
		0	**0**	**16**	**8**	**30**	**70**	**100**
Course Outcomes: At the end of the course, students will be able to								
CO1:	Identify project ideas, select strategies and methodologies to implement them; understand copy rights and classify the literature							
CO2:	Apply standard design and development procedures learnt; solve problems related to industry and society ensuring eco-friendly, public safety; and work effectively in teams							
CO3:	Utilize modern tools of CAD, optimization methods, numerical techniques including Design of Experiments and simulation that contribute to obtain the solution of the project problem							
CO4:	Develop prototype, perform tests to validate the prototype and analyse the cost and effectiveness							
CO5:	Organize the acquired knowledge through preparation of project report and communicate through oral presentations							

List of Professional Elective Courses

Professional Elective – IV

1. Mechanical Vibrations
2. Additive Manufacturing
3. Design of Automobile Transmission Systems
4. Mechatronics & MEMS
5. Power Plant Engineering

Professional Elective –V

1. Non Conventional Energy Sources
2. Industrial Robotics
3. Non Destructive Testing
4. Quality and Reliability Engineering
5. Smart Manufacturing

MECHANICAL VIBRATIONS (MV)							
VII Semester: Mechanical Engineering						**Scheme: 2023**	
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exam**	**TOTAL**
ME403	**PE-IV**	**3**	**0**	**0**	**3**	**30**	**70**	**100**
Sessional Exam Duration: 2 Hrs					**End Exam Duration: 3 Hrs**			

Course Outcomes: At the end of the course, students will be able to	
CO1:	Understand theory of vibration, classical method and energy method to find the equation of vibrating system, viscous damping, under damping, critical damping, over damping and solve related problems.
CO2:	Understand the concepts of motion excitation, transmissibility, isolation, seismic instruments, accelerometer, vibrometer.
CO3:	Compute natural frequencies and mode shapes for two degree freedom systems.
CO4:	Solve problems on multi degree freedom systems using Influence co-efficient method, Stodola method, Holzer's method and Matrix iteration method.
CO5:	Estimate natural frequency of transverse vibrations of simply supported beam with point load and Uniformly distributed load using Rayleigh's and Dunkerley's methods, and critical speed of a shaft with and without damping.

UNIT – I

Single Degree Freedom Systems: Undamped free vibration: Classical method, Energy method, equivalent systems.

Damped Free Vibration: Viscous damping, under damping, critical damping, over damping, equivalent damping coefficient, Simple problems.

UNIT – II

Single Degree Freedom Systems with Forced Vibration: Steady state forced Vibration, sources of excitation, impressed harmonic force, and impressed force due to unbalance.

Support Excitation: Motion excitation, transmissibility and isolation, performance of different type of isolators. General theory of seismic instruments, accelerometer and vibrometer.

UNIT – III

Two Degree Freedom Systems: Natural frequencies and modes of vibration by classical method of spring-mass system, forced vibration, semi definite systems, Coupled systems, dynamic vibration absorber.

UNIT – IV

Multi Degree Freedom Systems: Influence co-efficient method, Matrix method, Stodola method, Holzer's method, Matrix iteration method, orthogonality of mode shapes.

UNIT – V

Transverse Vibrations: Natural frequencies of beams- Simply supported beam with point load and uniformly distributed load. Rayleigh's and Dunkerley's methods.

Critical Speed of the shaft: Whirling of shafts, critical speed of shafts, and critical speed of shafts with and without damping.

Text Books:

1. G K Grover, Mechanical Vibrations, New Chand and Bro's Publishers, Roorkee
2. V P Singh, Mechanical Vibrations, Dhanpat Rai and Sons Publishers, New Delhi

Reference Books:	
1.	Thomson William T, Vibration Theory and Applications, Pearson Education, New Delhi
2.	J S Rao and K Guptha, Theory and Practice of Mechanical Vibrations, WEL Publishers, New Dehi
3.	Timoshenko S P and Young DH, Introductory Course on Vibration Problems in Engineering, John Wiley and Sons Publishers, Singapore
4.	Singiresu S Rao, Mechanical Vibrations, Pearson Education, New Delhi
5.	R Venkatachalam, Mechanical Vibrations,PHI Learning, New Delhi.
Online Learning Resources	
1.	https://nptel.ac.in/courses/112107212
2.	https://nptel.ac.in/courses/112103111
3.	https://nptel.ac.in/courses/112103112
4.	https://nptel.ac.in/courses/101105081
Question Paper Pattern:	

Sessional Exam: The question paper for Sessional Examination shall be for 40 marks. The question paper shall consist of Four questions and all questions are compulsory. Question No.1 shall contain Five compulsory short answer questions for a total of Ten marks. Question No.2 to 4 shall be EITHER/OR Type for Ten marks each. Student shall Answer any one of them. Each of these questions may contain sub-questions.

End Examination: The question paper for End Examination shall be for 70 marks. The Question paper shall contain Six Questions and all questions are compulsory. Question No.1 shall contain Ten compulsory short answer questions for a total of Twenty marks (with Two short answer questions from each unit). Question No.2 to 6 shall be EITHER/OR Type for Ten marks each and shall cover one Unit of the Syllabus for each question. Student shall Answer any one of them. Each of these questions may contain sub-questions.

ADDITIVE MANUFACTURING (ADM)

VII Semester: Mechanical Engineering					Scheme: 2023		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	Continuous Internal Assessment	End Exam	TOTAL
ME404	PE-IV	3	0	0	3	30	70	100
Sessional Exam Duration: 2 Hrs					End Exam Duration: 3 Hrs			

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

CO1:	Differentiate additive manufacturing from traditional machining and classify various AM processes and material types.
CO2:	Illustrate the principles and process parameters of Vat Photo-polymerization, Material Jetting, and Extrusion-based AM technologies.
CO3:	Illustrate the working mechanisms, material compatibility, and applications of Sheet Lamination, 3D Printing, and Powder Bed Fusion methods.
CO4:	Describe Direct Energy Deposition and Wire Arc AM processes and analyze critical parameters, challenges, and benefits using case studies.
CO5:	Implement post-processing techniques to enhance AM part quality and compare direct and indirect tooling methods for functional prototyping.

UNIT – I

Introduction to Additive Manufacturing: Introduction to AM, AM evolution, Distinction between AM & CNC machining, Steps in AM, Classification of AM processes, Advantages of AM and Types of materials for AM.

Vat Photo-polymerization AM Processes: Stereolithography (SL), Materials, Process Modeling, SL resin curing process, SL scan patterns, Micro-Stereolithography, Mask Projection Processes, Process Benefits and Drawbacks, Applications of Vat Photo-polymerization, case studies.

UNIT – II

Material Jetting AM Processes: Evolution of Printing as an Additive Manufacturing Process, Materials, Process Benefits and Drawbacks, Applications of Material Jetting Processes.

Binder Jetting AM Processes: Materials, Process Benefits and Drawbacks, Research achievements in printing deposition, Technical challenges in printing, Applications of Binder Jetting Processes.

Extrusion-Based AM Processes: Fused Deposition Modelling (FDM), Principles, Materials, Process Modelling, Plotting and path control, Bio-Extrusion, Contour Crafting, Process Benefits and Drawbacks, Applications of Extrusion-Based Processes, case studies.

UNIT – III

Sheet Lamination AM Processes: Bonding Mechanisms, Materials, Laminated Object Manufacturing (LOM), Ultrasonic Consolidation (UC), Gluing, Thermal bonding, LOM and UC applications, case studies.

Three Dimensional Printing (3DP): Principle, Process, Applications, advantages and disadvantages of 3DP

Powder Bed Fusion AM Processes: Selective laser Sintering (SLS), Materials, Powder fusion mechanism and powder handling, Process Modelling, SLS Metal and ceramic part creation, Electron Beam melting (EBM), Process Benefits and Drawbacks, Applications of Powder Bed Fusion Processes, case studies.

UNIT – IV

Direct Energy Deposition AM Processes: Process Description, Material Delivery, Laser Engineered Net Shaping (LENS), Direct Metal Deposition (DMD), Benefits and drawbacks,

Applications of Directed Energy Deposition Processes.
Wire Arc Additive Manufacturing: Process, parameters, applications, advantages and disadvantages, case studies.

UNIT – V
Post Processing of AM Parts: Support Material Removal, Surface Texture Improvement, Accuracy Improvement, Aesthetic Improvement, Property Enhancements using Non-thermal and Thermal Techniques.
Direct Methods of Rapid Tooling: AIM tooling, SLS rapid steel, Direct Laser Metal Sintering (DMLS), Laminate tooling.
Indirect Methods of Rapid Tooling: RTV silicon rubber moulds, Vacuum casting, Reaction injection Moulding(RIM),Wax Injection moulding, Spray metal tooling, 3D kelt tool

Text Books:

1. Chua C K, Leong K F, and Lim C, C S , Rapid Prototyping Principles and Applications, World Scientific Publishing Co. Pte. Ltd
2. D T Pham and S S Dimov, Rapid manufacturing The technologies and applications of rapid Prototyping and rapid tooling. Springer Publications

Reference Books:

1. Terry Wholers, Wholers report, Wholers Associates
2. Gibson D. W. Rosen and B. Stucker., Additive manufacturing technologies, Springer Publication

Online Resources:

1. https://www.nist.gov/additive-manufacturing
2. https://www.metal-am.com/
3. http://additivemanufacturing.com/basics/
4. https://www.3dprintingindustry.com/
5. https://www.thingiverse.com/
6. https://reprap.org/wiki/RepRap

Question Paper Pattern:

Sessional Exam: The question paper for Sessional Examination shall be for 40 marks. The question paper shall consist of Four questions and all questions are compulsory. Question No.1 shall contain Five compulsory short answer questions for a total of Ten marks. Question No.2 to 4 shall be EITHER/OR Type for Ten marks each. Student shall Answer any one of them. Each of these questions may contain sub-questions.

End Examination: The question paper for End Examination shall be for 70 marks. The Question paper shall contain Six Questions and all questions are compulsory. Question No.1 shall contain Ten compulsory short answer questions for a total of Twenty marks (with Two short answer questions from each unit). Question No.2 to 6 shall be EITHER/OR Type for Ten marks each and shall cover one Unit of the Syllabus for each question. Student shall Answer any one of them. Each of these questions may contain sub-questions.

DESIGN OF AUTOMOBILE TRANSMISSION SYSTEMS (DATS)

VII Semester: **Mechanical Engineering**							**Scheme: 2023**
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**	

Course Code	**Category**	**L**	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exam**	**TOTAL**
ME405	**PE-IV**	**3**	**0**	**0**	**3**	**30**	**70**	**100**

Sessional Exam Duration: 2 Hrs	**End Exam Duration: 3 Hrs**

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

CO1:	Design flexible power transmission systems using belts, chains and wire ropes.
CO2:	Analyze helical, bevel and worm gears.
CO3:	Design connecting rod, piston, flywheel and crank shaft.
CO4:	Create speed reducers and multi-speed gearboxes by developing structural and ray diagrams, selecting appropriate gear combinations for various mechanical applications.
CO5:	Design of clutches and brakes and choose appropriate friction materials for effective motion control.

UNIT – I

Flexible Power Transmission Systems: Design of Belts – Flat Belts and Pulleys – V Belts and Pulleys – Design of chain drives – Wire ropes

UNIT – II

Spur, Helical, Bevel and Worm Gears: Spur, Parallel Helical Gears – Kinematics – Tooth proportions – Force analysis – Stresses in Helical gear – Design of helical gear – Crossed Helical gears – Straight Bevel gears – Kinematics – Force analysis – Stresses in straight bevel gear tooth – Design of bevel gear – Worm gearing – Kinematics – Forces - Friction and Efficiencies – Stresses in worm gear tooth.

UNIT – III

Design of I.C. Engine Parts: Design of connecting rod, design of piston, design of crank and crankshafts.

UNIT – IV

Design of Gear Boxes: Design of Speed reducers – Design of multi speed gear boxes for machine tools – Structural and ray diagrams.

UNIT – V

Elements of Motion Control: Internal – Expanding Rim clutches and Brakes – External – Contracting Rim clutches and Brakes – Band type Clutches – Cone clutches and Brakes – Energy considerations – Temperature rise – Friction materials.

Text Books:

1. R L Norton, Machine Design an Integrated approach, Pearson Education, New Delhi
2. V B Bhandari, Design of Machine Elements, Tata McGraw Hill, New Delhi
3. R K Jain, Machine Design, Khanna Publications, New Delhi

Reference Books:

1. J E Shigley, Mechanical Engineering Design, Tata McGraw Hill, New Delhi
2. M F Spotts and T E Shoup, Design of Machine Elements, Prentice Hall (Pearson Education), London.
3. K Mahadevan and K Balaveera Reddy, Design data handbook, CBS Publications, New Delhi
4. N C Pandya and C S Shah, Machine design, Charotar Publishing House Pvt. Ltd, Gujarat.

Online Learning Resources
1. https://youtube.com/playlist?list=PLyqSpQzTE6M-7nTyaGekZRTLLUzGfRPMo&si=Jvicxjkhv8LS6Lt_
2. https://youtube.com/playlist?list=PLyqSpQzTE6M-7nTyaGekZRTLLUzGfRPMo&si=aFp27b3qPylydjCV
3. https://youtu.be/ftJKqKuppF4?si=wzfkYJUOeDxWHWRW
Question Paper Pattern:
Sessional Exam: The question paper for Sessional Examination shall be for 40 marks. The question paper shall consist of Four questions and all questions are compulsory. Question No.1 shall contain Five compulsory short answer questions for a total of Ten marks. Question No.2 to 4 shall be EITHER/OR Type for Ten marks each. Student shall Answer any one of them. Each of these questions may contain sub-questions.   **End Examination:** The question paper for End Examination shall be for 70 marks. The Question paper shall contain Six Questions and all questions are compulsory. Question No.1 shall contain Ten compulsory short answer questions for a total of Twenty marks (with Two short answer questions from each unit). Question No.2 to 6 shall be EITHER/OR Type for Ten marks each and shall cover one Unit of the Syllabus for each question. Student shall Answer any one of them. Each of these questions may contain sub-questions.

MECHATRONICS AND MEMS (MME)

VII Semester: Mechanical Engineering						Scheme : 2023	
Course Code	Category	Hours/Week			Credits	Maximum Marks	

Course Code	Category	L	T	P	C	Continuous Internal Assessment	End Exam	TOTAL
ME406	PE-IV							
		3	0	0	3	30	70	100

Sessional Exam Duration : 2 Hrs	End Exam Duration : 3 Hrs

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

CO1:	Define and explain the fundamental concepts and applications of mechatronics in industrial systems.
CO2:	Identify and analyze various types of sensors and their performance characteristics for specific applications.
CO3:	Design and evaluate actuator systems including hydraulic and pneumatic circuits for automation tasks.
CO4:	Understand and develop PLC ladder logic programs for industrial automation using sequencing, timers, counters, and analog I/O.
CO5:	Describe MEMS fabrication methods, apply and analyze the effect of scaling in micro electromechanical systems.

UNIT – I

Introduction: Definition of Mechatronics, Need for Mechatronics in Industry, Objectives of mechatronics, mechatronics design process, Mechatronics key elements, mechatronics applications – Computer numerical control (CNC) machines, Tool monitoring systems, Flexible manufacturing system (FMS), Industrial Robots, Automatic packaging systems, Automatic inspection systems.

UNIT – II

Sensors: Static and dynamic characteristics of sensors, Displacement, Position and Proximity sensors, Force and torque sensors, Pressure sensors, Flow sensors, Temperature sensors, Acceleration sensors, Level

UNIT – III

Actuators: Mechanical, Electrical, Hydraulic and Pneumatic Actuation systems, Characteristics and their limitations, Design of Hydraulic and Pneumatic circuits, Piezoelectric actuators, Shape memory alloys, Selection criteria for actuators.

UNIT – IV

Microprocessors, Microcontrollers and Programmable Logic Controllers: Architecture of Microprocessor, Microcontroller and Programmable Logic Controller, PLC Programming using ladder diagrams, logics, latching, sequencing, timers relays and counters, data handling, Analog input/output, selection of controllers.

UNIT – V

Micro Electro Mechanical Systems (MEMS): History, Effect of scaling, Fabrication Techniques: Oxidation, Physical Vapor disposition, Chemical Vapor Deposition, Lithography, Etching, Wafer bonding, LIGA, DRIE, Applications: Lab on chip.

Text Books:

1.	Bolton, Mechatronics Electronics Control Systems in Mechanical and Electrical Engineering, Pearson Education Press
2.	Devadas Shetty and Richard A Kolk, Mechatronic System Design, Cengage learning
3.	N Mahalik, MEMS, McGraw Hill Educations

Reference Books:

1.	Clarence W de Silva, Mechatronics an Integrated Approach, CRC Press
2.	James J Allen, Micro Electro Mechanical Systems Design, CRC Press Taylor & Francis

	group.
3.	Ganesh S Hedge, Mechatronics, Jones & Bartlett Learning
4.	Mohammed Gad, MEMS; Design and Fabrication, CRC Press

Online Learning Resources:

1.	https://onlinecourses.nptel.ac.in/noc22_me54/preview
2.	https://nptel.ac.in/courses/112108092
3.	https://nptel.ac.in/courses/112101304
4.	https://onlinecourses.nptel.ac.in/noc20_ee56/preview

Question Paper Pattern:

Sessional Exam: The question paper for Sessional Examination shall be for 40 marks. The question paper shall consist of Four questions and all questions are compulsory. Question No.1 shall contain Five compulsory short answer questions for a total of Ten marks. Question No.2 to 4 shall be EITHER/OR Type for Ten marks each. Student shall Answer any one of them. Each of these questions may contain sub-questions.

End Examination: The question paper for End Examination shall be for 70 marks. The Question paper shall contain Six Questions and all questions are compulsory. Question No.1 shall contain Ten compulsory short answer questions for a total of Twenty marks (with Two short answer questions from each unit). Question No.2 to 6 shall be EITHER/OR Type for Ten marks each and shall cover one Unit of the Syllabus for each question. Student shall Answer any one of them. Each of these questions may contain sub-questions.

POWER PLANT ENGINEERING (PPE)							
VII Semester: Mechanical Engineering						**Scheme: 2023**	
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exam**	**TOTAL**
ME407	**PE-IV**	**3**	**0**	**0**	**3**	**30**	**70**	**100**
Sessional Exam Duration: 2 Hrs					**End Exam Duration: 3 Hrs**			

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

CO1:	Understand sources of energy, power plant economics, and environmental aspects.
CO2:	Describe working components of a steam power plant.
CO3:	Illustrate the working mechanism of diesel and gas turbine power plants.
CO4:	Acquire the knowledge on hydro electric power plant.
CO5:	Demonstrate the working principle of solar, wind and nuclear power plants.

UNIT – I

Introduction to the Sources of Energy: Resources and Development of Power in India. Convectional and non- conventional energy sources, Power Plant Economics and Environmental Considerations: Capital Cost, Investment of Fixed Charges, Operating Costs, General Arrangement of Power Distribution, Load Curves, Load Duration Curve. Definitions of Connected Load, Maximum Demand, Demand Factor, Average Load, Load Factor, Diversity Factor - Tariff - Related Exercises. Effluents from Power Plants and Impact on Environment - Pollutants and Pollution Standards - Methods of Pollution Control. Inspection And Safety Regulations.

UNIT – II

Steam Power Plant : Introduction to Boilers- Modern High Pressure and Supercritical Boilers - Analysis of Power Plant Cycles - Modern Trends in Cycle Improvement - Waste Heat Recovery, Fluidized Bed Boilers., Fuel and Handling Equipments, Types of Coals, Coal Handling, Choice of Handling Equipment, Coal Storage, Ash Handling Systems.

Combustion Process : Properties of Coal - Overfeed and Under Feed Fuel Beds, Travelling Grate Stokers, Spreader Stokers, Retort Stokers, Pulverized Fuel Burning System And Its Components, Combustion Needs and Draught System, Cyclone Furnace, Design and Construction, Dust Collectors, Cooling Towers And Heat Rejection.

UNIT – III

Diesel Power Plant: Diesel Power Plant, Construction, Plant lay out with auxiliaries, fuel storage. GAS TURBINE PLANT: Introduction - Classification - Construction - Layout with Auxiliaries - Principles of Working Closed and Open Cycle Gas Turbines. Advantages And Disadvantages Combined Cycle Power Plants.

UNIT – IV

Hydro Electric Power Plant: Water Power - Hydrological Cycle / Flow Measurement - Drainage Area Characteristics - Hydrographs - Storage and Pondage - Classification of Dams and Spill Ways. Hydro Projects Plant: Types - Typical Layouts - Plant Auxiliaries - Plant Operation Pumped Storage Plants.

UNIT – V

Power from Non-Conventional Sources: Utilization of Solar Collectors- Working Principle, Wind Energy - Types of Turbines - HAWT & VAWT-Tidal Energy. MHD power Generation. Nuclear Power Station: Nuclear Fuel - Nuclear Fission, Chain Reaction, Breeding and Fertile Materials - Nuclear Reactor -Reactor Operation.

Types of Reactors: Pressurized Water Reactor and Boiling Water Reactor.

Text Books:	
1.	P K Nag, Power Plant Engineering, TMH Publications, New Delhi.
2.	M M EI Wakil, Power plant technology, TMH Publications, Singapore.
3.	G D Rai, An Introduction to Power Plant Technology, Khanna Publishers, New Delhi
Reference Books:	
1.	Ramalingam, Power plant Engineering, Scietech Publishers
2.	P C Sharma, S.K. Kataria Power Plant Engineering‖, Publications
3.	Arora and S Domakundwar, A course in Power Plant Engineering, Dhanpat Rai & Co (p) Ltd
4.	Elanchezhian , Power plant Engineering , I K International Publishers

Online Learning Resources:

1. https://nptel.ac.in/courses/112107291
2. https://youtube.com/playlist?list=PLLy_2iUCG87BT8H9uMufjrcPF5e6Qd2bz&si=RQhZwEibgqXK2dRL
3. https://youtube.com/playlist?list=PLLy_2iUCG87BT8H9uMufjrcPF5e6Qd2bz&si=LjgzdabT7tIsCwJC
4. https://youtu.be/IdPTuwKEfmA?si=PyF04z9beiVGkXAS

Question Paper Pattern:

Sessional Exam: The question paper for Sessional Examination shall be for 40 marks. The question paper shall consist of Four questions and all questions are compulsory. Question No.1 shall contain Five compulsory short answer questions for a total of Ten marks. Question No.2 to 4 shall be EITHER/OR Type for Ten marks each. Student shall Answer any one of them. Each of these questions may contain sub-questions.

End Examination: The question paper for End Examination shall be for 70 marks. The Question paper shall contain Six Questions and all questions are compulsory. Question No.1 shall contain Ten compulsory short answer questions for a total of Twenty marks (with Two short answer questions from each unit). Question No.2 to 6 shall be EITHER/OR Type for Ten marks each and shall cover one Unit of the Syllabus for each question. Student shall Answer any one of them. Each of these questions may contain sub-questions.

NON CONVENTIONAL ENERGY SOURCES (NCES)

VII Semester: Mechanical Engineering   **Scheme: 2023**

Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	Continuous Internal Assessment	End Exam	TOTAL
ME408	PE-V	3	0	0	3	30	70	100

Sessional Exam Duration: 2 Hrs   **End Exam Duration: 3 Hrs**

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

CO1:	Analyze the principles and applications of solar radiation, including its sources, characteristics, measurement, and environmental impact.
CO2:	Explain the principles of solar energy collection, storage methods, and applications in thermal and photovoltaic systems.
CO3:	Analyze the principles, technologies, and performance aspects of wind and biomass energy systems.
CO4:	Describe geothermal and ocean energy systems in terms of resources, technologies, and potential for sustainable power generation.
CO5:	Describe the need, working principles, and components of direct energy conversion systems.

UNIT – I

Principles of Solar Radiation: Role and potential of new and renewable source, the solar energy option, Environmental impact of solar power, physics of the sun, the solar constant, extra-terrestrial and terrestrial solar radiation, solar radiation on titled surface, instruments for measuring solar radiation and sun shine, solar radiation data.

UNIT – II

Solar Energy Collection: Principle of conversion of solar radiation into heat. Flat plate and concentrating collectors, classification of concentrating collectors, orientation and thermal analysis, advanced collectors.

Solar Energy Storage and Applications: Different methods, Sensible, latent heat and stratified storage, solar ponds. Solar Applications- solar heating/cooling technique, solar distillation and drying, photovoltaic energy conversion.

UNIT – III

Wind Energy: Sources and potentials, horizontal and vertical axis windmills, performance characteristics, Beltz criteria

Bio-Mass: Principles of Bio-Conversion, Anaerobic/aerobic digestion, types of Bio-gas digesters, gas yield, combustion characteristics of bio-gas, utilization for cooking, I. C. Engine operation and economic aspects.

UNIT – IV

Geothermal Energy: Resources, types of wells, methods of harnessing the energy, potential in India

Ocean Energy: OTEC, Principles utilization, setting of OTEC plants, thermodynamic cycles. Tidal and wave energy: Potential and conversion techniques, mini-tidal power plants, and their economics.

UNIT – V

Direct Energy Conversion: Need for DEC, Carnot cycle, limitations, and principles of DEC. Thermo-electric generators, Seebeck, Peltier and Joule Thomson effects, Figure of merit, materials, applications, MHD generators, principles, dissociation and ionization, hall effect, magnetic flux, MHD accelerator, MHD Engine, power generation systems, Fuel cells.

Text Books:	
1.	G.D Rai, Non-conventional Energy Sources, Khanna Publishers, New Delhi
2.	Anjaneyulu Yerramilli and Francis Tuluri Energy Resources Utilization and Technologies, BS Publications
3.	B H Khan, Non-conventional Energy Sources, TMH Publishers, New Delhi
Reference Books:	
1.	Twidell and Weir, Renewable Energy Sources, Routledge publisher
2.	B S Magal Frank Kreith and J F Kreith ,Solar Power Engineering, CRC press
3.	Ashok V Desai and Wiley Eastern ,Non-Conventional Energy, Wiley Eastern
4.	H P Garg and J Prakash, Solar energy fundamentals and applications, Tata McGraw Hill publishing Co. Ltd
Online Learning Resources:	
1.	https://youtube.com/playlist?list=PL3QMEfkolRFbGhXveCE7RFDBgY0_gRxkh&si=ZYwAnUNtmIwsIq
2.	https://youtube.com/playlist?list=PLfxYQ3zfSrafm79OhjA7hvdCgm29EKrcq&si=wBQZsw0JtePVc2f
3.	https://youtube.com/playlist?list=PLcWcvGXrBFeRV7f9oyuuX9RabYUuanGrK&si=TVHlSydk9cPw5MsV
4.	https://www.youtube.com/watch?v=mh51mAUexK4&list=PLwdnzlV3ogoXUifhvYB65lLJCZ74o_fAk
5.	https://www.youtube.com/watch?v=lP-7R9IVYbo&list=PLKZp-vhWn-c_v3V5w1jWNJmypZVx3dFS7

Question Paper Pattern:

Sessional Exam: The question paper for Sessional Examination shall be for 40 marks. The question paper shall consist of Four questions and all questions are compulsory. Question No.1 shall contain Five compulsory short answer questions for a total of Ten marks. Question No.2 to 4 shall be EITHER/OR Type for Ten marks each. Student shall Answer any one of them. Each of these questions may contain sub-questions.

End Examination: The question paper for End Examination shall be for 70 marks. The Question paper shall contain Six Questions and all questions are compulsory. Question No.1 shall contain Ten compulsory short answer questions for a total of Twenty marks (with Two short answer questions from each unit). Question No.2 to 6 shall be EITHER/OR Type for Ten marks each and shall cover one Unit of the Syllabus for each question. Student shall Answer any one of them. Each of these questions may contain sub-questions.

INDUSTRIAL ROBOTICS (IRT)							
VII Semester: Mechanical Engineering						**Scheme: 2023**	
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
ME409	PE-V	**L**	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exam**	**TOTAL**
		3	**0**	**0**	**3**	**40**	**60**	**100**
Sessional Exam Duration: 2 Hrs						**End Exam Duration: 3 Hrs**		

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

CO1:	Explain automation, robot anatomy and classifications of the robot
CO2:	Compare, Evaluate and chose end effectors/ sensors for robot
CO3:	Illustrate the robot manipulator, forward and reverse kinematics
CO4:	Demonstrate programming methods for robots
CO5:	Distinguish the manufacturing and processing applications of robot

UNIT – I

Fundamentals of Robotics and Robot technology: Automation and robotics, robot definition, robot anatomy, robot configurations, work volume, precession of movement, robot actuation and feed-back component, actuators, hydraulic actuators, electrical actuators (variable reluctance type and permanent magnet type stepper motor). Position sensors (potentiometer, resolvers, and encoders), velocity sensors (tachometer), power transmission devices.

UNIT – II

End Effectors and Sensors: Robot end effectors, types of end effectors, mechanical grippers, other type of grippers- Vacuum cups, magnetic grippers, adhesive grippers, Hooks, Scoops and other miscellaneous devices. Sensors in robotics- tactile sensors, proximity and range sensors, Machine Vision, use of sensors in robotics.

UNIT – III

Robot Motion Analysis and Control: Introduction to manipulator kinematics, position representation, forward transformation and reverse transformation of two degree freedom robot arm, three degree of freedom arm in two dimensions, four degree freedom manipulators in three dimension, homogeneous transformation and homogeneous transformation matrix.

UNIT – IV

Robot Programming: Methods of robot programming- Lead through- WAIT, SIGNAL and delay commands; The textual robot programming languages, robot language structures, constants, variables and other data objects, motion commands, end effectors, sensors commands and monitor mode commands.

Robot cell design and control: Robot cell layout, work cell control, interlocks, error detection and recovery, graphical simulation of robot work cell.

UNIT – V

Robot Applications in Manufacturing: Material transfer and machine loading and unloading general considerations in material handling.

Processing Operations: Spot welding, continuous arc welding, spray coating, and other processing operations.

Text Books:

1. Mickel P Groover, Mitchell Weiss, et. al, Industrial Robotics- Technology, Programming and Applications, McGraw Hill Publishers, New Delhi.

2. Deb S R, Robotics Technology and Flexible Automation, TMH Publishers, New Delhi.

3. Richard D Klafter, Thomas A Chmielewski and Michael Negin, Robotic Engineering: An

	Integrated Approach, Pearson Publications, New Jersey.
Reference Books:	
1.	Rama chandran Nagarajan, Introduction to Industrial Robotics, Pearson, India.
2.	K. S. Fu, Ralph C. Gonzalez and C.S.G. Lee, Robotics, control, sensing, vision, Mc Graw Hill, New York.
Question Paper Pattern:	

Sessional Exam: The question paper for Sessional Examination shall be for 40 marks. The question paper shall consist of Four questions and all questions are compulsory. Question No.1 shall contain Five compulsory short answer questions for a total of Ten marks. Question No.2 to 4 shall be EITHER/OR Type for Ten marks each. Student shall Answer any one of them. Each of these questions may contain sub-questions.

End Examination: The question paper for End Examination shall be for 70 marks. The Question paper shall contain Six Questions and all questions are compulsory. Question No.1 shall contain Ten compulsory short answer questions for a total of Twenty marks (with Two short answer questions from each unit). Question No.2 to 6 shall be EITHER/OR Type for Ten marks each and shall cover one Unit of the Syllabus for each question. Student shall Answer any one of them. Each of these questions may contain sub-questions.

NON DESTRUCTIVE TESTING (NDT)							
VII Semester: Mechanical Engineering						**Scheme: 2023**	
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
ME410	**PE-V**	**L**	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exam**	**TOTAL**
		3	**0**	**0**	**3**	**30**	**70**	**100**
Sessional Exam Duration: 2 Hrs						**End Exam Duration: 3 Hrs**		

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

CO1:	Understand the principles and classification of NDT methods for failure identification
CO2:	Interpret the theory of surface NDT and techniques involved in it
CO3:	Explain Thermography and Eddy current testing methods to detect the flaws
CO4:	Identify the flaws and leaks in the components using ultrasonic and acoustic emission Methods
CO5:	Utilize radiography to identify underlying failure sites

UNIT – I

Overview of NDT: NDT Versus Mechanical testing, Overview of the Non Destructive Testing Methods for the detection of manufacturing defects as well as material characterization. Relative merits and limitations, Various physical characteristics of materials and their applications in NDT, Visual inspection – Unaided and aided

UNIT – II

Surface NDT Methods: Liquid Penetrant Testing – Principles, types and properties of liquid penetrants, developers, advantages and limitations of various methods, Testing Procedure, Interpretation of results. Magnetic Particle Testing- Theory of magnetism, inspection materials, Magnetization methods, Interpretation and evaluation of test indications, Principles and methods of demagnetization, Residual magnetism.

UNIT – III

Thermography and Eddy Current Testing: Thermography- Principles, Contact and non-contact inspection methods, Techniques for applying liquid crystals, Advantages and limitation – infrared radiation and infrared detectors, Instrumentations and methods, applications Eddy Current Testing - Generation of eddy currents, Properties of eddy currents, Eddy current sensing elements, Probes, Instrumentation, Types of arrangement, Applications, advantages, Limitations, Interpretation/Evaluation

UNIT – IV

Ultrasonic Testing and Acoustic Emission: Ultrasonic Testing-Principle, Transducers, transmission and pulse-echo method, straight beam and angle beam, instrumentation, data representation, A-Scan, B-scan, C-scan. Phased Array Ultrasound, Time of Flight Diffraction Acoustic Emission Technique – Principle, AE parameters, Applications

UNIT – V

Radiography: Principle, interaction of X-Ray with matter, imaging, film and film less techniques, types and use of filters and screens, geometric factors, Inverse square law, characteristics of films – graininess, density, speed, contrast, characteristic curves, Penetrometers, Exposure charts, Radiographic equivalence. Fluoroscopy- Xero -Radiography, Computed Radiography, Computed Tomography

Text Books:

1. Baldev Raj, T Jaya Kumar, M Thavasimuthu, Practical Non-Destructive Testing, Narosa Publishing House

2. Ravi Prakash, Non-Destructive Testing Techniques, New Age International Publishers.

Reference Books:

1. ASM Metals Handbook, Non-Destructive Evaluation and Quality Control, American

	Society of Metals, Metals Park, Ohio, USA
2.	Paul E Mix, Introduction to Non-destructive testing: a training guide, Wiley, New Jersey
3.	Charles, J Hellier, Handbook of Non-Destructive evaluation, Mc Graw Hill, New York
4.	K Elagovan, V Jayakumar, Non-Destructive Testing of Materials, NM enterprise

Question Paper Pattern:

Sessional Exam: The question paper for Sessional Examination shall be for 40 marks. The question paper shall consist of Four questions and all questions are compulsory. Question No.1 shall contain Five compulsory short answer questions for a total of Ten marks. Question No.2 to 4 shall be EITHER/OR Type for Ten marks each. Student shall Answer any one of them. Each of these questions may contain sub-questions.

End Examination: The question paper for End Examination shall be for 70 marks. The Question paper shall contain Six Questions and all questions are compulsory. Question No.1 shall contain Ten compulsory short answer questions for a total of Twenty marks (with Two short answer questions from each unit). Question No.2 to 6 shall be EITHER/OR Type for Ten marks each and shall cover one Unit of the Syllabus for each question. Student shall Answer any one of them. Each of these questions may contain sub-questions.

QUALITY & RELIABILITY ENGINEERING (QRE)

VII Semester: Mechanical Engineering						Scheme: 2023	
Course Code	Category	Hours/Week			Credits	Maximum Marks	

		L	T	P	C	Continuous Internal Assessment	End Exam	TOTAL
ME411	PE-V	3	0	0	3	30	70	100

Sessional Exam Duration: 2 Hrs	End Exam Duration: 3 Hrs

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

CO1:	Understand the overview of the Total Quality Management system
CO2:	Understand concepts of customer satisfaction and employee involvement
CO3:	Apply the appropriate tools and techniques of continuous process improvement for controlling and improving quality
CO4:	Apply Quality Function Deployment and Bench Marking process for improving a product or process
CO5:	Understand concept of Reliability Engineering

UNIT – I

Introduction to T.Q.M.: Introduction to Quality; Evolution of and basic approach to Total Quality Management; Leadership concepts; The Seven habits of highly effective people; Role of TQM Leaders; Implementation of TQM; Quality council, quality statements

UNIT – II

Customer Satisfaction: Types of Customers-Internal and External; Customer perception of quality; Feedback & brief discussion on Information Collecting Tools

Employee Involvement: Maslow's hierarchy of needs; Types of Teams, Stages of team development, Common barriers to team progress, Training; Benefits of Employee Involvement

UNIT – III

Continuous Process Improvement: Introduction, Jurontrilogy, Improvement strategies; P-D-S-A cycle & Problem solving method; Basic concepts of Kaizen and Six sigma quality control, Taguchi method, Quality circles

Supplier Partnership: Introduction, Partnering, Sourcing, Supplier Selection, Supplier Rating, Relationship Development

Tools & Techniques of TQM : Pareto diagram, Cause & Effect diagram

UNIT – IV

Benchmarking: Introduction, Benchmarking process

Quality Function Deployment: Benefits of QFD, House of Quality

UNIT – V

Reliability Engineering: Introduction, Failures & failure modes, Causes of failures

Design for Reliability: Designing for higher Reliability, Reliability & Cost

Component Reliability: MTTF, Time dependent hazard models – Exponential Distribution

System Reliability: Systems with components- in Series, and in Parallel; Non-Series-Parallel systems

Redundancy Techniques: Introduction, Component & Unit Redundancy, Weakest link technique

Text Books:

1.	Dale H. Bester field, Total Quality Management, Pearson Education, New Delhi
2.	E Balagurusamy, Reliability Engineering, TMH Publishers, New Delhi

3.	M Mahajan, Statistical Quality Control, Dhanapat Rai and Sons Publishers, New Delhi

Reference Books:

1.	Douglas C Montgomery, Introduction to Quality Control, John Wiley and Sons Publishers, New York
2.	N Logothetis, Managing for Total Quality, From Deming to Taguchi, PHI Publishers, New Delhi
3.	L S Srinath, Reliability Engineering, East West Press, New Delhi

Question Paper Pattern:

Sessional Exam: The question paper for Sessional Examination shall be for 40 marks. The question paper shall consist of Four questions and all questions are compulsory. Question No.1 shall contain Five compulsory short answer questions for a total of Ten marks. Question No.2 to 4 shall be EITHER/OR Type for Ten marks each. Student shall Answer any one of them. Each of these questions may contain sub-questions.

End Examination: The question paper for End Examination shall be for 70 marks. The Question paper shall contain Six Questions and all questions are compulsory. Question No.1 shall contain Ten compulsory short answer questions for a total of Twenty marks (with Two short answer questions from each unit). Question No.2 to 6 shall be EITHER/OR Type for Ten marks each and shall cover one Unit of the Syllabus for each question. Student shall Answer any one of them. Each of these questions may contain sub-questions.

SMART MANUFACTURING (SMF)

VII Semester: Mechanical Engineering					Scheme: 2023		
Course Code	Category	Hours/Week			Credits	Maximum Marks	
ME412	PE-V	**L**	**T**	**P**	**C**	Continuous Internal Assessment	End Exam	TOTAL

Course Code	Category	L	T	P	C	Continuous Internal Assessment	End Exam	TOTAL
ME412	PE-V	3	0	0	3	30	70	100

Sessional Exam Duration: 2 Hrs	End Exam Duration: 3 Hrs

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

CO1:	Explain the evolution of Smart Manufacturing, Industry 4.0 and IoT in Manufacturing.
CO2:	Explain the concepts of Data Analytics and Artificial Intelligence in Manufacturing.
CO3:	Demonstrate the role of Smart Sensors, RFID, and Block chain in Manufacturing.
CO4:	Summarize the techniques of Digital Twin & Simulation in Manufacturing.
CO5:	Analyze the importance of Sustainable and Green Manufacturing.

UNIT – I

Introduction to Smart Manufacturing: Definition, Evolution, and Importance of Smart Manufacturing, Industry 4.0 and Its Impact on Manufacturing, Traditional vs. Smart Manufacturing, Key Technologies in Smart Manufacturing.

Cyber-Physical Systems & Industrial IoT (IIoT): Basics of Cyber-Physical Systems (CPS), Internet of Things (IoT) in Manufacturing, Smart Sensors and Actuators Communication Protocols (MQTT, OPC-UA, Modbus).

UNIT – II

Data Analytics and Artificial Intelligence in Manufacturing: Role of Big Data in Manufacturing, Machine Learning & Deep Learning for Smart Manufacturing, Predictive Maintenance and Anomaly Detection, Digital Twin Technology.

Automation & Robotics in Smart Manufacturing: Industrial Automation: PLCs, SCADA, and DCS, Autonomous Robots and Cobots (Collaborative Robots), Additive Manufacturing (3D Printing), Case Studies of Smart Factories.

UNIT – III

Cloud Computing and Edge Computing in Manufacturing: Introduction to Cloud Computing for Manufacturing, Edge and Fog Computing in Real-time Manufacturing Systems, Cloud-based Manufacturing Execution Systems (MES)

Smart Sensors, RFID, and Block chain in Manufacturing: Role of Smart Sensors and RFID in Inventory Management, Block chain for Secure Supply Chains Smart Contracts and Decentralized Manufacturing Systems.

UNIT – IV

Digital Twin & Simulation in Manufacturing: Digital Twin Technology and Virtual Prototyping, Simulation Software for Smart Manufacturing, Augmented Reality (AR) and Virtual Reality (VR) in Industry 4.0

Cybersecurity in Smart Manufacturing: Threats and Risks in Smart Manufacturing, Cybersecurity Frameworks for Industrial Systems, Best Practices for Securing IoT and IIoT Devices.

UNIT – V

Sustainable and Green Manufacturing: Energy Efficiency in Smart Manufacturing, Sustainable Supply Chain Management, Role of AI in Green Manufacturing.

Case Studies and Future Trends: Case Studies of Leading Smart Manufacturing Companies, Emerging Technologies in Smart Manufacturing, Future of Industry 5.0 and Beyond.

Text Books:	
1.	J Paulo Davim, Green Manufacturing Processes and Systems, Springer, Germany.
2.	Kamalakar Mutalik , Smart Manufacturing, The Write Order Publishers, India
Reference Books:	
1.	Rajkumar E, and V G Sridhar, Introduction to smart manufacturing an Automation, Namya Press Publishers, New Delhi.
Question Paper Pattern:	

Sessional Exam: The question paper for Sessional Examination shall be for 40 marks. The question paper shall consist of Four questions and all questions are compulsory. Question No.1 shall contain Five compulsory short answer questions for a total of Ten marks. Question No.2 to 4 shall be EITHER/OR Type for Ten marks each. Student shall Answer any one of them. Each of these questions may contain sub-questions.

End Examination: The question paper for End Examination shall be for 70 marks. The Question paper shall contain Six Questions and all questions are compulsory. Question No.1 shall contain Ten compulsory short answer questions for a total of Twenty marks (with Two short answer questions from each unit). Question No.2 to 6 shall be EITHER/OR Type for Ten marks each and shall cover one Unit of the Syllabus for each question. Student shall Answer any one of them. Each of these questions may contain sub-questions.

List of Open Elective Courses

Open Elective – III

1. Building Materials and Services
2. Environmental Impact Assessment
3. Smart Grid Technologies
4. 3D Printing Technologies
5. Composite Materials
6. Applications of Microprocessors and Microcontrollers
7. Introduction to Database Systems
8. Cyber Security
9. Modern C++
10. Wavelet Transforms and its Applications
11. Smart Materials and Devices
12. Green Chemistry and Catalysis for Sustainable Environment
13. Employability Skills
14. Introduction to Quantum Mechanics

Open Elective – IV

1. Geo-Spatial Technologies
2. Solid Waste Management
3. Electric Vehicles
4. Total Quality Management
5. Safety in Engineering Industry
6. Transducers and Sensors
7. Drone Technology
8. Introduction to Computer Networks
9. Internet of Things
10. Multimedia & Animation
11. Advanced Information Systems
12. Quantum Computing
13. Financial Mathematics
14. Sensors and Actuators for Engineering Applications
15. Chemistry of Nanomaterials and Applications
16. Literary Vibes

BUILDING MATERIALS AND SERVICES (BMS)							
VII Semester: All Branches Except CE					**Scheme: 2023**		
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
OE701	OE-III	**L**	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exam**	**TOTAL**
		3	0	0	3	30	70	100
Sessional Exam Duration: 2 Hrs					**End Exam Duration: 3 Hrs**		

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

CO1:	Understand the properties, classifications, and applications of building materials like stones, bricks, tiles, wood, aluminum, and plastics
CO2:	Analyze the composition, manufacturing process, and properties of cement and admixtures.
CO3:	Apply knowledge of building components such as lintels, arches, stairs, floors, roofs, foundations
CO4:	Evaluate masonry, mortars, finishing techniques ,and form work systems
CO5:	Assess various building services including plumbing, ventilation, acoustics, and fire protection.

UNIT – I

Building Materials:

Building Stones: Classifications– Properties – Structural Requirements.

Bricks: Composition of Brick Earth – Qualities of good brick – Types of brick.

Tiles: Characteristics of good tile– Types of tiles.

Wood: Structure – Types and Properties – Seasoning.

Other Materials: Properties and uses of Steel, Aluminum and Plastics.

UNIT – II

Cement & Admixtures: Types of Cement - Ingredients of Cement – Manufacture – Chemical Composition – Hydration - Field & Lab Tests – Fineness – Consistency– Initial &Final Setting – Soundness. Admixtures – Mineral & Chemical Admixtures – Uses

UNIT – III

Building Components:

Foundations: Types.

Floors: Types of Floors.

Roofs: Flat, Curved, Trussed.

Stair Cases – terminology: Types.

Lintels and Arches.

UNIT – IV

Mortars: Lime and Cement Mortars

Masonry: Bonds in Brick Masonry and Stone Masonry

Finishers: Plastering, Pointing, Painting.

Form Work: Types, Requirements – Scaffolding.

UNIT – V

Building Services:

Plumbing Services: Water Distribution, Sanitary – Lines &Fittings;

Ventilations: Functional Requirements – Natural and Mechanical ventilation

Acoustics: Characteristic – Absorption – Acoustic Design.	
Fire Protection: Fire Hazards – Classification of Fire Resistant Materials and Constructions.	

Text Books:

1. Building Materials and Construction–Arora & Bindra, Dhanpat Roy Publications

2. Building Materials and Construction by G C Sahu, Joygopal Jena McGraw hill Pvt. Ltd., 2015

Reference Books:

1. Building Construction by B. C. Punmia, Ashok Kumar Jain and Arun Kumar Jain - Laxmi Publications (P) ltd., New Delh

2. P.C.Varghese, Building Materials, Prentice Hall of India, 2015.

3. N.Subramanian, Building Materials Testing and Sustainability, Oxford Higher Education, 2019.

4. R. Chudley, Construction Technology, Longman Publishing Group, 1973.

5. S. K. Duggal, Building Materials, Oxford & IBH Publishing Co. Ltd., New Delhi, 2019

Online Learning Resources:

1. https://archive.nptel.ac.in/courses/105/102/105102088/

Question Paper Pattern:

Sessional Exam: The question paper for Sessional Examination shall be for 40 marks. The question paper shall consist of Four questions and all questions are compulsory. Question No.1 shall contain Five compulsory short answer questions for a total of Ten marks. Question No.2 to 4 shall be EITHER/OR Type for Ten marks each. Student shall Answer any one of them. Each of these questions may contain sub-questions.

End Examination: The question paper for End Examination shall be for 70 marks. The Question paper shall contain Six Questions and all questions are compulsory. Question No.1 shall contain Ten compulsory short answer questions for a total of Twenty marks (with Two short answer questions from each unit). Question No.2 to 6 shall be EITHER/OR Type for Ten marks each and shall cover one Unit of the Syllabus for each question. Student shall Answer any one of them. Each of these questions may contain sub-questions.

ENVIRONMENTAL IMPACT ASSESSMENT (EIA)							
VII Semester: All Branches					**Scheme: 2023**		
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exam**	**TOTAL**
OE702	**OE-III**	3	0	0	3	30	70	100
Sessional Exam Duration: 2 Hrs					**End Exam Duration: 3 Hrs**			

Course Outcomes : At the end of the course, students will be able to	
CO1:	Apply various methodologies for conducting Environmental Impact Assessments
CO2:	Analyze the impact of land-use changes on soil, water, and air quality.
CO3:	Evaluate the environmental impact on vegetation, wildlife, and conduct risk assessments.
CO4:	Develop environmental audit reports and assess compliance with environmental policies.
CO5:	Interpret and apply environmental acts and regulations related to EIA.

UNIT – I

Concepts and methodologies of EIA: Initial Environmental Examination, Elements of EIA, - Factors Affecting E-I-A Impact Evaluation and Analysis, Preparation of Environmental Base Map, Classification of Environmental Parameters- Criteria for The Selection of EIA Methodology, E I A Methods, Ad-Hoc Methods, Matrix Methods, Network Method Environmental Media Quality Index Method, Overlay Methods and Cost/Benefit Analysis.

UNIT – II

Impact of Developmental Activities and Land Use: Introduction and Methodology for The Assessment of Soil and Ground Water, Delineation of Study Area, Identification of Actives. Procurement of Relevant Soil Quality, Impact Prediction, Assessment of Impact Significance, Identification and Incorporation of Mitigation Measures. E I A in Surface Water, Air and Biological Environment: Methodology for The Assessment of Impacts on Surface Water Environment, Air Pollution Sources, Generalized Approach for Assessment of Air Pollution Impact.

UNIT – III

Assessment of Impact on Vegetation, Wildlife and Risk Assessment: Introduction - Assessment of Impact of Development Activities On Vegetation and Wildlife, Environmental Impact of Deforestation – Causes and Effects of Deforestation - Risk Assessment and Treatment of Uncertainty-Key Stages in Performing An Environmental Risk Assessment-Advantages of Environmental Risk Assessment.

UNIT – IV

Environmental Audit: Introduction - Environmental Audit & Environmental Legislation Objectives of Environmental Audit, Types of Environmental Audit, Audit Protocol, Stages of Environmental Audit, Onsite Activities, Evaluation of Audit Data and Preparation of Audit Report

UNIT – V

Environmental Acts and Notifications: The Environmental Protection Act, The Water Preservation Act, The Air(Prevention &Control of Pollution Act), Wild Life Act - Provisions in The EIA Notification, Procedure for Environmental Clearance, Procedure for Conducting Environmental Impact Assessment Report- Evaluation of EIA Report. Environmental Legislation Objectives, Evaluation of Audit Data and Preparation of Audit Report. Post Audit

Activities, Concept of ISO and ISO 14000.

Text Books:

1.	Environmental Impact Assessment Methodologies, by Y. Anjaneyulu, B. S. Publication, Hyderabad 2nd edition 2011
2.	Environmental Impact Assessment, by Canter Larry W., McGraw-Hill education Edi (1996)

Reference Books:

1.	Environmental Engineering, by Peavy, H. S, Rowe, D. R, Tchobanoglous, G.Mc-Graw Hill International Editions, New York 1985.
2.	Environmental Science and Engineering, by Suresh K. Dhaneja, S.K., Katania& Sons Publication, New Delhi
3.	Environmental Science and Engineering, by J. Glynn and Gary W. Hein Ke, Prentice Hall Publishers.
4.	Environmental Pollution and Control, by H. S. Bhatia, Galgotia Publication (P) Ltd, Delhi

Online Learning Resources:

1.	https://archive.nptel.ac.in/courses/124/107/124107160/

Question Paper Pattern:

Sessional Exam: The question paper for Sessional Examination shall be for 40 marks. The question paper shall consist of Four questions and all questions are compulsory. Question No.1 shall contain Five compulsory short answer questions for a total of Ten marks. Question No.2 to 4 shall be EITHER/OR Type for Ten marks each. Student shall Answer any one of them. Each of these questions may contain sub-questions.

End Examination: The question paper for End Examination shall be for 70 marks. The Question paper shall contain Six Questions and all questions are compulsory. Question No.1 shall contain Ten compulsory short answer questions for a total of Twenty marks (with Two short answer questions from each unit). Question No.2 to 6 shall be EITHER/OR Type for Ten marks each and shall cover one Unit of the Syllabus for each question. Student shall Answer any one of them. Each of these questions may contain sub-questions.

SMART GRID TECHNOLOGIES (SGT)							
VII Semester: All Branches Except EEE							**Scheme: 2023**
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exam**	**TOTAL**
OE703	**OE-III**	**3**	**0**	**0**	**3**	**30**	**70**	**100**
Sessional Exam Duration: 2 Hrs					**End Exam Duration: 3 Hrs**			

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

CO1:	Understanding the Concept and Evolution of Smart Grids.
CO2:	Analyzing Wide Area Monitoring System and Synchrophasor Technology.
CO3:	Applying Smart Metering and Advanced Metering Infrastructure (AMI) Concepts.
CO4:	Evaluating Information and Communication Technology (ICT) Systems in Smart Grids.
CO5:	Designing Smart Grid Applications and Cybersecurity Measures.

UNIT – I

Introduction to Smart Grid: Evolution of Electric Grid – Need for Smart Grid – Difference between conventional & smart grid – Overview of enabling technologies – International experience in Smart Grid deployment efforts – Smart Grid road map for India – Smart Grid Architecture.

UNIT – II

Wide Area Monitoring System: Fundamentals of Synchro phasor Technology – concept and benefits of Wide Area Monitoring System – Structure and functions of Phasor Measuring Unit (PMU) and Phasor Data Concentrator (PDC) – Road Map for Synchrophasor applications (NAPSI) – Operational experience and Blackout analysis using PMU - Case study on PMU.

UNIT – III

Smart Meters: Features and functions of Smart Meters – Functional specification – category of Smart Meters – Automatic Meter Reading (AMR) and Advanced Metering Infrastructure (AMI) drivers and benefits – AMI protocol – Demand Side Integration: Peak load, Outage and Power Quality management.

UNIT – IV

Information and Communication Technology: Overview of Smart Grid Communication system – Modulation and Demodulation Techniques: Radio Communication – Mobile Communication – Power Line Communication – Optical Fibre Communication – Communication Protocol for Smart Grid.

UNIT – V

Smart Grid Applications and Cyber Security: Applications: Overview and concept of Renewable Integration – Introduction to distributed generation - Role of Protective Relaying in Smart Grid – House Area Network – Advanced Energy Storage Technology: Flow battery – Fuel cell – SMES – Super capacitors – Plug – in Hybrid electric Vehicles - Cyber Security: Security issues in DG, Distribution Automation, AMI, Electric Vehicle Management Systems – Approach to assessment of smart grid cyber security risks – Methodologies. Cyber Security requirements – Smart Grid Information Model.

Text Books:

1. James Momoh, "SMART GRID: Fundamentals of Design and Analysis", John Wiley and Sons, New York, 2012.

2.	Janaka Ekanayake, Nick Jenkins, Kithsiri Liyanage, Jianzhong Wu, Akihiko Yokoyama, "Smart Grid: Technology and Applications", John Wiley & Sons, New Jersey, 2012.

Reference Books:

1.	Power Grid Corporation of India Limited, "Smart Grid Primer", 1st Edition, Power Grid Corporation of India Limited, Bangalore, India, 2013.
2.	Fereidoon. P. Sioshansi, "Smart Grid – Integrating Renewable, Distributed and Efficient Energy", 1st Edition, Academic Press, USA, 2011.
3.	Stuart Borlase, "Smart Grids: Infrastructure, Technology and Solutions", 1st Edition, CRC Press Publication, England, 2013.
4.	Phadke A G, Thorp J S, "Synchronized Phasor Measurements and Their Applications", 1st Edition, Springer, Newyork, 2012.

Online Learning Resources:

1.	https://nptel.ac.in/courses/108107113

Question Paper Pattern:

Sessional Exam: The question paper for Sessional Examination shall be for 40 marks. The question paper shall consist of Four questions and all questions are compulsory. Question No.1 shall contain Five compulsory short answer questions for a total of Ten marks. Question No.2 to 4 shall be EITHER/OR Type for Ten marks each. Student shall Answer any one of them. Each of these questions may contain sub-questions.

End Examination: The question paper for End Examination shall be for 70 marks. The Question paper shall contain Six Questions and all questions are compulsory. Question No.1 shall contain Ten compulsory short answer questions for a total of Twenty marks (with Two short answer questions from each unit). Question No.2 to 6 shall be EITHER/OR Type for Ten marks each and shall cover one Unit of the Syllabus for each question. Student shall Answer any one of them. Each of these questions may contain sub-questions.

3D PRINTING TECHNOLOGIES (3DPT)							
VII Semester: All Branches Except ME						**Scheme: 2023**	
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
OE704	**OE–III**	**L**	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exam**	**TOTAL**
		3	**0**	**0**	**3**	**30**	**70**	**100**
Sessional Exam Duration: 2 Hrs					**End Exam Duration: 3 Hrs**			

Course Outcomes : At the end of the course the student will be able to	
CO1:	Explain the fundamentals of AM, its process steps, classification, materials, and describe Vat Photo-polymerization methods with applications.
CO2:	Explain Material Jetting, Binder Jetting, and FDM processes in terms of materials, working principles, benefits, and illustrate their applications.
CO3:	Explain the working of Sheet Lamination, 3DP, and Powder Bed Fusion processes, and analyze their advantages and industrial use cases.
CO4:	Describe Directed Energy Deposition AM processes, benefits, and applications.
CO5:	Explain post-processing techniques in AM and understand the concepts of direct and indirect rapid tooling methods with examples.

UNIT – I

Introduction to Additive Manufacturing: Introduction to AM, AM evolution, Distinction between AM & CNC machining, Steps in AM, Classification of AM processes, Advantages of AM and Types of materials for AM.

Vat Photo-polymerization AM Processes: Stereolithography (SL), Materials, Process Modeling, SL resin curing process, SL scan patterns, Micro-Stereolithography, Mask Projection Processes, Process Benefits and Drawbacks, Applications of Vat Photo-polymerization, case studies.

UNIT – II

Material Jetting AM Processes: Evolution of Printing as an Additive Manufacturing Process, Materials, Process Benefits and Drawbacks, Applications of Material Jetting Processes.

Binder Jetting AM Processes: Materials, Process Benefits and Drawbacks, Research achievements in printing deposition, Technical challenges in printing, Applications of Binder Jetting Processes.

Extrusion-Based AM Processes: Fused Deposition Modelling (FDM), Principles, Materials, Process Modelling, Plotting and path control, Bio-Extrusion, Contour Crafting, Process Benefits and Drawbacks, Applications of Extrusion-Based Processes, case studies.

UNIT – III

Sheet Lamination AM Processes: Bonding Mechanisms, Materials, Laminated Object Manufacturing (LOM), Ultrasonic Consolidation (UC), Gluing, Thermal bonding, LOM and UC applications, case studies.

Three Dimensional Printing (3DP): Principle, Process, Applications, advantages and disadvantages of 3DP.

Powder Bed Fusion AM Processes: Selective laser Sintering (SLS), Materials, Powder fusion mechanism and powder handling, Process Modelling, SLS Metal and ceramic part creation, Electron Beam melting (EBM), Process Benefits and Drawbacks, Applications of Powder Bed Fusion Processes, case studies.

UNIT – IV

Directed Energy Deposition AM Processes: Process Description, Material Delivery, Laser Engineered Net Shaping (LENS), Direct Metal Deposition (DMD), Benefits and drawbacks, Applications of Directed Energy Deposition Processes.

UNIT – V

Post Processing of AM Parts: Support Material Removal, Surface Texture Improvement, Accuracy Improvement, Aesthetic Improvement, Property Enhancements using Non-thermal and Thermal Techniques.

Rapid Tooling: Direct and Indirect methods AIM tooling, SLS rapid steel, Direct Laser Metal Sintering (DMLS), Laminate tooling. RTV silicon rubber moulds, Vacuum casting, Reaction injection Moulding (RIM),Wax Injection moulding, Spray metal tooling, 3D kelt tool

Text Books:

1. Chua C.K., Leong.K.F, and Lim C, C.S., Rapid Prototyping Principles and Applications, World Scientific Publishing Co. Pte. Ltd

2. D.T.Pham and S.S.Dimov, Rapid manufacturing The technologies and applications of rapid Prototyping and rapid tooling. Springer Publications

Reference Books:

1. Terry Wholers, Wholers report, Wholers Associates

2. Gibson D. W. Rosen and B. Stucker., Additive manufacturing technologies, Springer Publication

Online Resources:

1. https://www.nist.gov/additive-manufacturing
2. https://www.metal-am.com/
3. http://additivemanufacturing.com/basics/
4. https://www.3dprintingindustry.com/
5. https://www.thingiverse.com/
6. https://reprap.org/wiki/RepRap

Question Paper Pattern:

Sessional Exam: The question paper for Sessional Examination shall be for 40 marks. The question paper shall consist of Four questions and all questions are compulsory. Question No.1 shall contain Five compulsory short answer questions for a total of Ten marks. Question No.2 to 4 shall be EITHER/OR Type for Ten marks each. Student shall Answer any one of them. Each of these questions may contain sub-questions.

End Examination: The question paper for End Examination shall be for 70 marks. The Question paper shall contain Six Questions and all questions are compulsory. Question No.1 shall contain Ten compulsory short answer questions for a total of Twenty marks (with Two short answer questions from each unit). Question No.2 to 6 shall be EITHER/OR Type for Ten marks each and shall cover one Unit of the Syllabus for each question. Student shall Answer any one of them. Each of these questions may contain sub-questions.

COMPOSITE MATERIALS (CM)							
VII Semester: All Branches						**Scheme: 2023**	
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**	
OE705	OE-III	**L**	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exam**	**TOTAL**
		3	0	0	3	30	70	100
Sessional Exam Duration: 2 Hrs						**End Exam Duration: 3 Hrs**	

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

CO1:	Identify the properties of fiber and matrix materials used in commercial composites.
CO2:	Describe the manufacture of polymer matrix composites.
CO3:	Compare and evaluate the metal manufacturing methods.
CO4:	Analyze the Hooke's law for different type of materials.
CO5:	Examine the elastic behaviour of the unidirectional composite.

UNIT – I

Basic Concepts and Characteristics: Geometric and Physical definitions, natural and man-made composites, Aerospace and structural applications, types and classification of composites.

Reinforcements: Fibers- Glass, Silica, Kevlar, carbon, boron, silicon carbide, and boron carbide fibers. Particulate composites, Polymer composites, Thermoplastics, Thermosets, Metal matrix and ceramic composites

UNIT – II

Manufacturing of Polymer Composites: Autoclave, tape production, moulding methods, filament winding, hand layup, pultrusion, Resin Transfer Moulding, injection moulding, compression moulding Properties and applications.

UNIT – III

Manufacturing of Metal Matrix Composites: Stir Casting – Solid State diffusion technique, Cladding – Hot isostatic pressing. Properties and applications.

Manufacturing of Ceramic Matrix Composites: Liquid Metal Infiltration – Liquid phase sintering.

Manufacturing of Carbon – Carbon Composites: Knitting, Braiding, Weaving. Properties and applications.

UNIT – IV

Coordinate Transformations: Hooke's law for different types of materials, Hooke's law for two dimensional unidirectional lamina, Transformation of stress and strain, Numerical examples of stress strain transformation.

UNIT – V

Elastic Behaviour of Unidirectional Composites: Elastic constants of lamina, relationship between engineering constants and reduced stiffness and compliances, analysis of laminated composites, constitutive relations.

Text Books:

1.	R M Jones, Mechanics of Composite Materials Mc Graw Hill Company, New York.
2.	Isaac and M.Daniel, Engineering Mechanics of Composite Materials, Oxford University Press, New York

Reference Books:

1.	Madhujit Mukhopadadhyay, Mechanics of composite materials and structures, Universities Press, Hyderabad
2.	L. R. Calcote, Analysis of Laminated Composite Structures ,Van Nostrand Rainfold, US
3.	B. D. Agarwal and L. J. Broutman, Analysis and performance of fibre Composites, Wiley Interscience, New York

Question Paper Pattern:

Sessional Exam: The question paper for Sessional Examination shall be for 40 marks. The question paper shall consist of Four questions and all questions are compulsory. Question No.1 shall contain Five compulsory short answer questions for a total of Ten marks. Question No.2 to 4 shall be EITHER/OR Type for Ten marks each. Student shall Answer any one of them. Each of these questions may contain sub-questions.

End Examination: The question paper for End Examination shall be for 70 marks. The Question paper shall contain Six Questions and all questions are compulsory. Question No.1 shall contain Ten compulsory short answer questions for a total of Twenty marks (with Two short answer questions from each unit). Question No.2 to 6 shall be EITHER/OR Type for Ten marks each and shall cover one Unit of the Syllabus for each question. Student shall Answer any one of them. Each of these questions may contain sub-questions.

APPLICATIONS OF MICROPROCESSORS AND MICROCONTROLLERS (AMMC)

VII Semester: All Branches Except EEE and ECE

Scheme: 2023

Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	Continuous Internal Assessment	End Exam	TOTAL
OE706	OE-III	3	0	0	3	30	70	100

Sessional Exam Duration: 2 Hrs **End Exam Duration: 3 Hrs**

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

CO1:	Analyze the architectural concepts of 8086 microprocessor.
CO2:	Apply the programming model of 8086 in assembly language programming.
CO3:	Analyze the multiple concepts of 8086 interfacing.
CO4:	Analyze the architectural concepts the 8051 microcontroller.
CO5:	Apply the programming model of 8051 in interfacing with peripherals.

UNIT – I

8086 Architecture: Main features, pin diagram/description, 8086 microprocessor family, internal architecture, bus interfacing unit, execution unit, interrupts and interrupt response, 8086 system timing, minimum mode and maximum mode configuration.

UNIT – II

8086 Programming: Program development steps, instructions, addressing modes, assembler directives, writing simple programs with an assembler, assembly language program development tools.

UNIT – III

8086 Interfacing: Semiconductor memories interfacing (RAM, ROM), Intel 8255 programmable peripheral interface, Interfacing switches and LEDS, Interfacing seven segment displays, software and hardware interrupt applications, Intel 8251 USART architecture and interfacing, Intel 8237a DMA controller, stepper motor, A/D and D/A converters, Need for 8259 programmable interrupt controllers.

UNIT – IV

8051 Microcontroller: Architecture of 8051 – Special Function Registers (SFRs) - I/O Pins Ports and Circuits - Instruction set - Addressing modes - Assembly language programming.

UNIT – V

Interfacing Microcontroller: Programming 8051 Instruction set - Addressing modes Programming Switches, LEDs, Displays – Seven Segment, LCD, Sensors, Stepper Motor and Waveform generation- Comparison of Microprocessor, Microcontroller, PIC and ARM processors

Text Books:

1. K M Bhurchandi, A K Ray, Advanced Microprocessors and Peripherals, 3rd edition, McGraw Hill Education, 2017.

2. Mazidi Muhammad Ali, Mazidi Janice Gillespie & Mc KinlayRolin D, The 8051Microcontroller and Embedded Systems, 2nd Edition, Pearson Education, 2008.

3. Raj Kamal, Microcontrollers: Architecture, Programming, Interfacing and System Design, 2ndedition, Pearson, 2012.

Reference Books:	
1.	John Uffenbeck, The 8086/8088 Family: Design, Programming, and Interfacing, 3rd Edition, Pearson Ed, 2006.
2.	Kenneth J. Ayala, The 8051 Microcontroller, Penram International Publication Ltd, 2006.
Online Learning Resources:	
1.	www.nptel.onlinecourseac.in/.microprocessorsandmicrocontrollers
2.	https://onlinecourses.nptel.ac.in/noc18_ec03/
Question Paper Pattern:	

Sessional Exam: The question paper for Sessional Examination shall be for 40 marks. The question paper shall consist of Four questions and all questions are compulsory. Question No.1 shall contain Five compulsory short answer questions for a total of Ten marks. Question No.2 to 4 shall be EITHER/OR Type for Ten marks each. Student shall Answer any one of them. Each of these questions may contain sub-questions.

End Examination: The question paper for End Examination shall be for 70 marks. The Question paper shall contain Six Questions and all questions are compulsory. Question No.1 shall contain Ten compulsory short answer questions for a total of Twenty marks (with Two short answer questions from each unit). Question No.2 to 6 shall be EITHER/OR Type for Ten marks each and shall cover one Unit of the Syllabus for each question. Student shall Answer any one of them. Each of these questions may contain sub-questions.

INTRODUCTION TO DATABASE SYSTEMS (IDS)							
VII Semester: CE, EEE, ME and ECE						**Scheme: 2023**	
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
OE707	**OE-III**	**L**	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exam**	**TOTAL**
		3	**0**	**0**	**3**	**30**	**70**	**100**
Sessional Exam Duration: 2 Hrs					**End Exam Duration: 3 Hrs**			

Course Outcomes : At the end of the course, students will be able to	
CO1:	Understand the basic concepts of database management systems
CO2:	Analyze a given database application scenario to use ER model for conceptual design of the database
CO3:	Utilize SQL proficiently to address diverse query challenges.
CO4:	Employ normalization methods to enhance database structure.
CO5:	Assess and implement transaction processing, concurrency control and database recovery protocols in databases.

UNIT – I

Introduction: Database system, Characteristics (Database Vs File System), Database Users, Advantages of Database systems, Database applications. Brief introduction of different Data Models; Concepts of Schema, Instance and data independence; Three tier schema architecture for data independence; Database system structure, environment, Centralized and Client Server architecture for the database.

UNIT – II

Entity Relationship Model: Introduction, the building blocks of an entity relationship diagram, classification of entity sets, attribute classification, relationship degree, relationship classification, reducing ER diagram to tables, enhanced entity-relationship model (EER model), generalization and specialization, IS A relationship and attribute inheritance, multiple inheritance, constraints on specialization and generalization, advantages of ER modelling.

UNIT – III

Schema Refinement (Normalization): Purpose of Normalization or schema refinement, concept of functional dependency, normal forms based on functional dependency Lossless join and dependency preserving decomposition, (1NF, 2NF and 3 NF), concept of surrogate key, Boyce-Codd normal form(BCNF), MVD, Fourth normal form(4NF), Fifth Normal Form (5NF)

UNIT – IV

Structured Query Language: Introduction, History of SQL Standard, Commands in SQL, Data Types in SQL, Data Definition Language, Selection Operation, Projection Operation, Aggregate functions, Data Manipulation Language, Table Modification Commands, Join Operation, Set Operations, View, Sub Query.

UNIT – V

PL/SQL: Introduction, Shortcomings of SQL, Structure of PL/SQL, PL/SQL Language Elements, Data Types, Operators Precedence, Control Structure, Steps to Create a PL/SQL, Program, Iterative Control, Procedure, Function, Database Triggers, Types of Triggers.

Text Books:

1. Database Management Systems, 3rd edition, Raghurama Krishnan, Johannes Gehrke, TMH

2.	Database System Concepts,5th edition, Silberschatz, Korth, Sudarsan,
3.	SQL: The Ultimate Beginners Guide by Steve Tale
Reference Books:	
1.	Introduction to Database Systems, 8thedition, C J Date, Pearson
2.	Database Management System, 6th edition, RamezElmasri, Shamkant B. Navathe, Pearson
3.	Database Principles Fundamentals of Design Implementation and Management, Corlos Coronel, Steven Morris, Peter Robb, Cengage Learning.
Online Learning Resources:	
1.	https://nptel.ac.in/courses/106/105/106105175/
2.	https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_01275806667282 02 2456_shared/overview
3.	Oracle SQL Developer - Full Course
4.	https://www.youtube.com/watch?v=9ic3KEH4Ah4
Question Paper Pattern:	

Sessional Exam: The question paper for Sessional Examination shall be for 40 marks. The question paper shall consist of Four questions and all questions are compulsory. Question No.1 shall contain Five compulsory short answer questions for a total of Ten marks. Question No.2 to 4 shall be EITHER/OR Type for Ten marks each. Student shall Answer any one of them. Each of these questions may contain sub-questions.

End Examination: The question paper for End Examination shall be for 70 marks. The Question paper shall contain Six Questions and all questions are compulsory. Question No.1 shall contain Ten compulsory short answer questions for a total of Twenty marks (with Two short answer questions from each unit). Question No.2 to 6 shall be EITHER/OR Type for Ten marks each and shall cover one Unit of the Syllabus for each question. Student shall Answer any one of them. Each of these questions may contain sub-questions.

CYBER SECURITY (CS)							
VII Semester: CE, EEE, ME and ECE							**Scheme: 2023**
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
OE708	**OE-III**	**L**	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exam**	**TOTAL**
		3	0	0	3	30	70	100
Sessional Exam Duration: 2 Hrs					**End Exam Duration: 3 Hrs**			

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

CO1:	Classify the cybercrimes and understand the Indian ITA 2000.
CO2:	Analyse the vulnerabilities in any computing system and find the solutions.
CO3:	Predict the security threats of the future.
CO4:	Investigate the protection mechanisms.
CO5:	Design security solutions for organizations

UNIT – I

Introduction to Cyber crime: Introduction, Cybercrime, and Information Security, Who are Cybercriminals, Classifications of Cybercrimes, and Cybercrime: The Legal Perspectives and Indian Perspective, Cybercrime and the Indian ITA 2000, A Global Perspective on Cybercrimes.

UNIT – II

Cyber Offenses: How Criminals Plan Them: Introduction, How Criminals plan the Attacks, Social Engineering, Cyber stalking, Cyber cafe and Cybercrimes, Botnets: The Fuel for Cybercrime, Attack Vector, Cloud Computing.

UNIT – III

Cyber crime: 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.

UNIT – IV

Tools and Methods Used in Cyber crime: Introduction, Proxy Servers and Anonymizers, Phishing, Password Cracking, Key loggers and Spywares, Virus and Worms, Trojan Horse and Backdoors, Steganography, DoS and DDoS attacks, SQL Injection, Buffer Overflow.

UNIT – V

Cyber Security: Organizational Implications: Introduction, Cost of Cybercrimes and IPR issues, Web threats for Organizations, Security and Privacy Implications, Social media marketing: Security Risks and Perils for Organizations, Social Computing and the associated challenges for Organizations.

Text Books:

1. Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives, Nina Godbole and Sunil Belapure, Wiley INDIA.

Reference Books:

1. Cyber Security Essentials, James Graham, Richard Howard and Ryan Otson, CRC Press.

2. Introduction to Cyber Security , Chwan –Hwa (john) Wu ,J. DavidIrwin.CRC Press T&F Group

Online Learning Resources:

1.	https://onlinecourses.nptel.ac.in/noc23_cs127/preview
2.	https://www.udemy.com/course/cybersecurity-from-beginner-to-expert

Question Paper Pattern:

Sessional Exam: The question paper for Sessional Examination shall be for 40 marks. The question paper shall consist of Four questions and all questions are compulsory. Question No.1 shall contain Five compulsory short answer questions for a total of Ten marks. Question No.2 to 4 shall be EITHER/OR Type for Ten marks each. Student shall Answer any one of them. Each of these questions may contain sub-questions.

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MODERN C++ (MC)							
VII Semester: All Branches						**Scheme: 2023**	
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
OE709	**OE-III**	**L**	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exam**	**TOTAL**
		3	0	0	3	30	70	100
Sessional Exam Duration: 2 Hrs					**End Exam Duration: 3 Hrs**			

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

CO1:	Distinguish the procedural and object oriented paradigm along with principles
CO2:	Understand dynamic memory management techniques using pointers, constructors, destructors
CO3:	Understand the concept of function overloading, operator overloading, virtual functions and polymorphism.
CO4:	Classify inheritance with the understanding of early and late binding.
CO5:	Illustrate the process of data file manipulations using C++.
CO6:	Analyze an ability to incorporate Exception handling in Object Oriented program.

UNIT – I

Object-Oriented Thinking: Different paradigms for problem solving, need for OOP paradigm, differences between OOP and Procedure oriented programming, Overview of OOP concepts Abstraction, Encapsulation, Inheritance and Polymorphism

C++ Basics: Structure of a C++ program, Data types, Declaration of variables, Expressions, Operators, Operator Precedence, Evaluation of expressions, Type conversions, Pointers, Arrays, Pointers and Arrays, Strings, Structures, References. Flow control statement- if, switch, while, for, do, break, continue, go to statements. Functions - Scope of variables, Parameter passing, Default arguments, inline functions, Recursive functions, Pointers to functions

UNIT – II

C++ Classes and Data Abstraction: Class definition, Class structure, Class objects, Class scope, this pointer, Friends to a class, Static class members, Constant member functions, Constructors and Destructors, Dynamic creation and destruction of objects, Data abstraction, ADT and information hiding.

UNIT – III

Inheritance: Defining a class hierarchy, Different forms of inheritance, Defining the Base and Derived classes, Access to the base class members, Base and Derived class construction, Destructors, Virtual base class.

UNIT – IV

Virtual Functions and Polymorphism: Static and Dynamic binding, virtual functions, Dynamic binding through virtual functions, Virtual function call mechanism, Pure virtual functions, Abstract classes, Implications of polymorphic use of classes, Virtual destructors.

UNIT – V

C++ I/O: I/O using C functions, Stream classes hierarchy, Stream I/O, File streams and String streams, Overloading operators, Error handling during file operations, Formatted I/O

Exception Handling:

Benefits of exception handling, Throwing an exception, The try block, Catching an exception, Exception objects, Exception specifications.

Text Books:	
1.	The Complete Reference C++, 4th Edition, Herbert Schildt, Tata McGraw Hill.
2.	Problem solving with C++: The Object of Programming, 4th Edition, Walter Savitch, Pearson Education.
Reference Books:	
1.	The C++ Programming Language, 3rd Edition, B. Stroutstrup, Pearson Education
2.	OOP in C++, 3rd Edition, T. Gaddis, J. Walters and G. Muganda, Wiley Dream Tech Press
3.	Object Oriented Programming in C++, 3rd Edition, R. Lafore, Galigotia Publications Pvt Ltd
Online Learning Resources:	
1.	https://nptel.ac.in/courses/106105234
2.	https://www.geeksforgeeks.org/cpp/c-plus-plus/
3.	https://www.tutorialspoint.com/cplusplus/index.htm
Question Paper Pattern:	

Sessional Exam: The question paper for Sessional Examination shall be for 40 marks. The question paper shall consist of Four questions and all questions are compulsory. Question No.1 shall contain Five compulsory short answer questions for a total of Ten marks. Question No.2 to 4 shall be EITHER/OR Type for Ten marks each. Student shall Answer any one of them. Each of these questions may contain sub-questions.

End Examination: The question paper for End Examination shall be for 70 marks. The Question paper shall contain Six Questions and all questions are compulsory. Question No.1 shall contain Ten compulsory short answer questions for a total of Twenty marks (with Two short answer questions from each unit). Question No.2 to 6 shall be EITHER/OR Type for Ten marks each and shall cover one Unit of the Syllabus for each question. Student shall Answer any one of them. Each of these questions may contain sub-questions.

WAVELET TRANSFORMS AND ITS APPLICATIONS (WTA)							
VII Semester: All Branches						**Scheme: 2023**	
Course Code	Category	Hours/Week			Credits	Maximum Marks		
OE710	OE-III	L	T	P	C	Continuous Internal Assessment	End Exam	TOTAL
		3	0	0	3	30	70	100
Sessional Exam Duration: 2 Hrs					**End Exam Duration: 3 Hrs**			

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

CO1:	Understand wavelets and wavelet basis and characterize continuous and discrete wavelet transforms.
CO2:	Illustrate the multi resolution analysis ad scaling functions.
CO3:	Implement discrete wavelet transforms with multirate digital filters.
CO4:	Understand multi resolution analysis and identify various wavelets and evaluate their time- frequency resolution properties.
CO5:	Design certain classes of wavelets to specification and justify the basis of the application of wavelet transforms to different fields.

UNIT – I

Wavelets: Wavelets and Wavelet Expansion Systems - Wavelet Expansion- Wavelet Transform- Wavelet System- More Specific Characteristics of Wavelet Systems -Haar Scaling Functions and Wavelets -effectiveness of Wavelet Analysis -The Discrete Wavelet Transform-The Discrete Time and Continuous Wavelet Transforms.

UNIT – II

A Multi resolution Formulation of Wavelet Systems: Signal Spaces -The Scaling Function -Multiresolution Analysis - The Wavelet Functions - The Discrete Wavelet Transform- A Parseval's Theorem - Display of the Discrete Wavelet Transform and the Wavelet Expansion.

UNIT – III

Filter Banks and the Discrete Wavelet Transform: Analysis - From Fine Scale to Coarse Scale- Filtering and Down-Sampling or Decimating - Synthesis - From Coarse Scale to Fine Scale -Filtering and Up-Sampling or Stretching - Input Coefficients - Lattices and Lifting - - Different Points of View.

UNIT – IV

Time-Frequency and Complexity: Multiresolution versus Time-Frequency Analysis- Periodic versus Nonperiodic Discrete Wavelet Transforms -The Discrete Wavelet Transform versus the Discrete-Time Wavelet Transform-Numerical Complexity of the Discrete Wavelet Transform.

UNIT – V

Bases and Matrix Examples: Bases, Orthogonal Bases, and Biorthogonal Bases -Matrix Examples - Fourier Series Example - Sine Expansion Example - Frames and Tight Frames - Matrix Examples -Sine Expansion as a Tight Frame Example.

Text Books:

1. C. Sidney Burrus, Ramesh A. Gopinath, ―Introduction to Wavelets and Wavelets Transforms‖, Prentice Hall, (1997).

2. James S. Walker, ―A Primer on Wavelets and their Scientific Applications‖, CRC Press, (1999).

Reference Books:

1. Raghuveer Rao, ―"Wavelet Transforms", Pearson Education, Asia

2. C. S. Burrus, Ramose and A. Gopinath, Introduction to Wavelets and Wavelet Transform, Prentice Hall Inc.

Question Paper Pattern:

Sessional Exam: The question paper for Sessional Examination shall be for 40 marks. The question paper shall consist of Four questions and all questions are compulsory. Question No.1 shall contain Five compulsory short answer questions for a total of Ten marks. Question No.2 to 4 shall be EITHER/OR Type for Ten marks each. Student shall Answer any one of them. Each of these questions may contain sub-questions.

End Examination: The question paper for End Examination shall be for 70 marks. The Question paper shall contain Six Questions and all questions are compulsory. Question No.1 shall contain Ten compulsory short answer questions for a total of Twenty marks (with Two short answer questions from each unit). Question No.2 to 6 shall be EITHER/OR Type for Ten marks each and shall cover one Unit of the Syllabus for each question. Student shall Answer any one of them. Each of these questions may contain sub-questions.

	SMART MATERIALS AND DEVICES (SMD)						

VII Semester: All Branches						Scheme: 2023	
Course Code	Category	Hours/Week			Credits	Maximum Marks	
OE711	OE-III	L	T	P	C	Continuous Internal Assessment	End Exam	TOTAL
		3	0	0	3	30	70	100
Sessional Exam Duration: 2 Hrs						End Exam Duration: 3 Hrs	

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

CO1:	Provide exposure to smart materials and their engineering applications.
CO2:	Impart knowledge on the basics and phenomenon behind the working of smart materials
CO3:	Explain the properties exhibited by smart materials.
CO4:	Educate various techniques used to synthesize and characterize smart materials
CO5:	Identify the required smart material for distinct applications/devices

UNIT – I

Introduction to Smart Materials: Historical account of the discovery and development of smart materials, Shape memory materials, chromo active materials, magnet orheological materials, photoactive materials, Polymers and polymer composites (Basics).

UNIT – II

Properties of Smart Materials: Optical, Electrical, Dielectric, Piezoelectric, Ferroelectric, Pyroelectric and Magnetic properties of smart materials.

UNIT – III

Synthesis of Smart Materials: Chemical route: Chemical vapour deposition, Sol-gel technique, Hydrothermal method, Mechanical alloying and Thin film deposition techniques: Chemical etching, Spray pyrolysis.

UNIT – IV

Characterization Techniques: Powder X-ray diffraction, Raman spectroscopy (RS), UV-Visible spectroscopy, Scanning electron microscopy (SEM), Transmission electron microscopy (TEM), Atomic force microscopy (AFM).

UNIT – V

Smart Materials Based Devices: Devices based on smart materials: Shape memory alloys in robotic hands, piezoelectric based devices, MEMS and intelligent devices.

Text Books:

1. Yaser Dahman, Nanotechnology and Functional Materials for Engineers-,Elsevier, 2017
2. E. Zschech,C. Whelan, T. Mikolajick, Materials for Information Technology: Devices, Interconnects and Packaging Springer-Verlag London Limited 2005.

Reference Books:

1. P Gauenzi, Smart Structures, Wiley, 2009.
2. Mahmood Ali of khazraei, Handbook of functional nanomaterials, Vol (1&2), Nova Publishers, 2014
3. Handbook of Smart Materials, Technologies, and Devices: Applications of Industry,4.0, Chaudhery Mustansar Hussain, Paolo Di Sia, Springer,2022.
4. Fundamentals of Smart Materials, Mohsen Shahinpoor, Royal Society of Chemistry, 2020

Question Paper Pattern:

Sessional Exam: The question paper for Sessional Examination shall be for 40 marks. The question paper shall consist of Four questions and all questions are compulsory. Question No.1 shall contain Five compulsory short answer questions for a total of Ten marks. Question No.2 to 4 shall be EITHER/OR Type for Ten marks each. Student shall Answer any one of them. Each of these questions may contain sub-questions.

End Examination: The question paper for End Examination shall be for 70 marks. The Question paper shall contain Six Questions and all questions are compulsory. Question No.1 shall contain Ten compulsory short answer questions for a total of Twenty marks (with Two short answer questions from each unit). Question No.2 to 6 shall be EITHER/OR Type for Ten marks each and shall cover one Unit of the Syllabus for each question. Student shall Answer any one of them. Each of these questions may contain sub-questions.

GREEN CHEMISTRY AND CATALYSIS FOR SUSTAINABLE ENVIRONMENT (GCSE)							
VII Semester: All Branches						**Scheme: 2023**	
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**	
OE712	**OE-III**	**L**	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exam**	**TOTAL**
		3	0	0	3	30	70	100
Sessional Exam Duration: 2 Hrs						**End Exam Duration: 3 Hrs**	

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

CO1:	Understand principle and concepts of green chemistry.
CO2:	Understand the types of catalysis and industrial applications.
CO3:	Apply green solvents in chemical synthesis.
CO4:	Enumerate different sourced of green energy.
CO5:	Apply alternative greener methods foe chemical reactions.

UNIT – I

Principles And Concepts of Green Chemistry: Introduction, Green chemistry Principles, sustainable development and green chemistry, E factor, atom economy, atom economic Reactions: Rearrangement and addition reactions and atom un- economic reactions: Substitution, elimination and Wittig reactions, Reducing Toxicity. Waste - problems and Prevention: Design for degradation, Polymer recycling.

UNIT – II

Catalysis And Green Chemistry: Introduction, Types of catalysis, Heterogeneous catalysis: Basics of Heterogeneous Catalysis, Zeolite and the Bulk Chemical Industry, Heterogeneous Catalysis in the Fine Chemical and Pharmaceutical Industries, Catalytic Converters, Homogeneous catalysis: Transition Metal Catalysts with Phosphine Ligands, Greener Lewis Acids, and Phase transfer catalysis, Bio- catalysis and Photo-catalysis with examples.

UNIT – III

Green Solvents In Chemical Synthesis: Green Solvents: Concept, Tools and techniques for solvent selection, supercritical fluids: Super critical carbondioxide, super critical water, Polyethyleneglycol (PEG), Ionic liquids, Recyling of green solvents.

UNIT – IV

Emerging Greener Technologies: Biomass as renewable resource, Energy: Energy from Biomass, Solar Power, Chemicals from Renewable Feedstock's, Chemicals from Fatty Acids, Polymers from Renewable Resources, Alternative Economies: The Syngas Economy, The Bio refinery, Design for energy efficiency, Mechanochemical synthesis.

UNIT – V

Alternative Greener Methods: Photochemical Reactions - Examples, Advantages and Challenges, Photoredox catalysis, single electron transfer reactions (SET), Examples of Photochemical Reactions, Microwave-assisted Reactions and Sonochemical reactions, examples and applications.

Text Books:

1. M. Lancaster,Green Chemistry an introductory text, Royal Society of Chemistry, 2002.

2. Paul T. Anastas and John C. Warner, Green Chemistry Theory and Practice, 4th Edition, Oxford University Press, USA

Reference Books:

1. Green Chemistry for Environmental Sustainability, First Edition, Sanjay K. Sharma and

	AckmezMudhoo, CRC Press, 2010.
2.	AlvisePerosa and Maurizio Selva , Hand Book of Green chemistry Volume 8: Green Nanoscience, wiley-VCH, 2013.

Sessional Exam: The question paper for Sessional Examination shall be for 40 marks. The question paper shall consist of Four questions and all questions are compulsory. Question No.1 shall contain Five compulsory short answer questions for a total of Ten marks. Question No.2 to 4 shall be EITHER/OR Type for Ten marks each. Student shall Answer any one of them. Each of these questions may contain sub-questions.

End Examination: The question paper for End Examination shall be for 70 marks. The Question paper shall contain Six Questions and all questions are compulsory. Question No.1 shall contain Ten compulsory short answer questions for a total of Twenty marks (with Two short answer questions from each unit). Question No.2 to 6 shall be EITHER/OR Type for Ten marks each and shall cover one Unit of the Syllabus for each question. Student shall Answer any one of them. Each of these questions may contain sub-questions.

EMPLOYABILITY SKILLS (ESK)							
VII Semester: All Branches						**Scheme: 2023**	
Course Code	Category	Hours/Week			Credits	Maximum Marks		
OE713	OE-III	**L**	**T**	**P**	**C**	Continuous Internal Assessment	End Exam	TOTAL
		3	0	0	3	30	70	100
Sessional Exam Duration: 2 Hrs					**End Exam Duration: 3 Hrs**			

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

CO1: Understand the importance of goals and try to achieve them.

CO2: Explain the significance of self-management.

CO3: Apply the knowledge of writing skills in preparing eye-catchy resumes.

CO4: Analyse various forms of Presentation skills.

CO5: Judge the group behaviour appropriately.

CO6: Develop skills required for employability

UNIT – I

Goal Setting and Self-Management: Definition, importance, types of Goal Setting – SMART Goal Setting – Advantages-Motivation – Intrinsic and Extrinsic Motivation – Self-Management - Knowing about self – SWOC Analysis

UNIT – II

Writing Skills: Definition, significance, types of writing skills – Resume writing Vs CV Writing - E-Mail writing, Cover Letters - E-Mail Etiquette -SoP (Statement of Purpose)

UNIT – III

Technical Presentation Skills: Nature, meaning & significance of Presentation Skills – Planning, Preparation, Presentation, Stage Dynamics –Anxiety in Public speaking (Glossophobia)- PPT & Poster Presentation

UNIT – IV

Group Presentation Skills: Body Language – Group Behaviour - Team Dynamics – Leadership Skills – Personality Manifestation- Group Discussion-Debate –Corporate Etiquette

UNIT – V

Job Cracking Skills: Nature, characteristics, importance & types of Interviews – Job Interviews – Skills for success – Job searching skills - STAR method - FAQs- Answering Strategies – Mock Interviews

Text Books:

1. Sabina Pillai, Agna Fernandez. Soft Skills & Employability Skills,2014.Cambridge Publisher

2. Alka Wadkar. Life Skills for Success, Sage Publications, 2016.

Reference Books:

1. Gangadhar Joshi. Campus to Corporate Paperback , Sage Publications. 2015

2. Sherfield Montogomery Moody,Cornerstone Developing Soft Skills, Pearson Publications. 4 Ed. 2008

3. Sherfield Montogomery Moody,Cornerstone Developing Soft Skills, Pearson Publications. 4 Ed. 2008

4. M. Sen Gupta, Skills for Employability, Innovative Publication, 2019.

5.	Steve Duck and David T McMahan, The Basics f Communication Skills A Relational Perspective, Sage press, 2012

Online Learning Resources:

1. https://youtu.be/gkLsn4ddmTs
2. https://youtu.be/2bf9K2rRWwo
3. https://youtu.be/FchfE3c2jzc
4. https://youtu.be/xBaLgJZ0t6A?list=PLzf4HHlsQFwJZel_j2PUy0pwjVUgj7KlJ
5. https://www.youtube.com/c/skillopedia/videos
6. https://onlinecourses.nptel.ac.in/noc25_hs96/preview
7. https://onlinecourses.nptel.ac.in/noc21_hs76/preview
8. https://archive.nptel.ac.in/courses/109/107/109107172/#
9. https://archive.nptel.ac.in/courses/109/104/109104107/

Question Paper Pattern:

Sessional Exam: The question paper for Sessional Examination shall be for 40 marks. The question paper shall consist of Four questions and all questions are compulsory. Question No.1 shall contain Five compulsory short answer questions for a total of Ten marks. Question No.2 to 4 shall be EITHER/OR Type for Ten marks each. Student shall Answer any one of them. Each of these questions may contain sub-questions.

End Examination: The question paper for End Examination shall be for 70 marks. The Question paper shall contain Six Questions and all questions are compulsory. Question No.1 shall contain Ten compulsory short answer questions for a total of Twenty marks (with Two short answer questions from each unit). Question No.2 to 6 shall be EITHER/OR Type for Ten marks each and shall cover one Unit of the Syllabus for each question. Student shall Answer any one of them. Each of these questions may contain sub-questions.

INTRODUCTION TO QUANTUM MECHANICS (IQM)							
VII Semester: All Branches						**Scheme: 2023**	
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**	
OE714	OE-III	**L**	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exam**	**TOTAL**
		3	0	0	3	30	70	100
Sessional Exam Duration: 2 Hrs					**End Exam Duration: 3 Hrs**		

Course Outcomes : At the end of the course, students will be able to	
CO1:	Explain the key principles of quantum mechanics and wave-particle duality
CO2:	Apply Schrödinger equations to solve one-dimensional quantum problems
CO3:	Solve quantum mechanical problems using operator and matrix methods.
CO4:	Evaluate quantum states using Dirac notation and expectation values.
CO5:	Analyze angular momentum and spin systems using Pauli matrices and operators.

UNIT – I

Principles of Quantum Mechanics: Introduction, Limitations of classical Mechanics, Difficulties with classical theories of black body radiation and origin of quantum theory of radiation. Wave-particle duality: de Broglie wavelength, Heisenberg uncertainty principle. Schrödinger time independent and time dependent wave equation, Solution of the time dependent Schrödinger equation, Concept of stationary states, Physical significance of wave function (ψ), Orthogonal, Normalized and Orthonormal functions

UNIT – II

One Dimensional Problems and Solutions: Potential step – Reflection and Transmission at the interface. Potential well: Square well potential with rigid walls, Square well potential with finite walls. Potential barrier: Penetration of a potential barrier (tunneling effect). Periodic potential and Harmonic oscillator, Energy eigen functions and eigen values.

UNIT – III

Operator Formalism: Operators, Operator Algebra, Eigen values and Eigen vectors, Postulates of quantum mechanics, Matrix representation of wave functions and linear operators.

UNIT – IV

Mathematical Tools for Quantum Mechanics: The concept of row and column matrices, Matrix algebra, Hermitian operators – definition. Dirac's bra and ket notation, Expectation values, Heisenberg (operator) representation of harmonic oscillator, Ladder operators and their significance.

UNIT – V

Angular Momentum and Spin: Angular momentum operators: Definition. Eigen functions and Eigen values of AM operators. Matrix representation of angular momentum operators, System with spin half (1/2), Spin angular momentum, Pauli's spin matrices. Clebsch-Gordon coefficients. Rigid Rotator: Eigen functions and Eigen values.

Text Books:	
1.	Quantum Mechanics. Vol 1, A. MessaiaNoth-Holland Pub. Co., Amsterdam, 1961.
2.	A Text Book of Quantum Mechanics. P.M.Mathews and K.Venkatesam, Tata McGraw Hill, New Delhi.
3.	Introduction to Quantum Mechanics. R.H.Dicke and J.P.Witke, Addison-Wisley Pub. Co. Inc., London, (1960).

4.	Quantum Mechanics. S L Gupta, V Kumar, H V Sarama and R C Sharma, Jai Prakash Nath & Co, Meerut, (1996).

Reference Books:

1.	Quantum Mechanics. L.I. Schiff, McGraw Hill Book Co., Tokyo, (1968).
2.	Introduction to Quantum Mechanics. Richard L. Liboff, Pearson Education Ltd (Fourth Edn.), 2003.

Online Learning Resources:

1.	https://archive.nptel.ac.in/courses/115/101/115101107/
2.	https://archive.nptel.ac.in/courses/122/106/122106034/
3.	https://nptel.ac.in/courses/115106066

Question Paper Pattern:

Sessional Exam: The question paper for Sessional Examination shall be for 40 marks. The question paper shall consist of Four questions and all questions are compulsory. Question No.1 shall contain Five compulsory short answer questions for a total of Ten marks. Question No.2 to 4 shall be EITHER/OR Type for Ten marks each. Student shall Answer any one of them. Each of these questions may contain sub-questions.

End Examination: The question paper for End Examination shall be for 70 marks. The Question paper shall contain Six Questions and all questions are compulsory. Question No.1 shall contain Ten compulsory short answer questions for a total of Twenty marks (with Two short answer questions from each unit). Question No.2 to 6 shall be EITHER/OR Type for Ten marks each and shall cover one Unit of the Syllabus for each question. Student shall Answer any one of them. Each of these questions may contain sub-questions.

GEO-SPATIAL TECHNOLOGIES (GST)							
VII Semester: All Branches Except CE						**Scheme: 2023**	
Course Code	Category	Hours/Week			Credits	Maximum Marks		
OE715	OE-IV	L	T	P	C	Continuous Internal Assessment	End Exam	TOTAL
		3	0	0	3	30	70	100
Sessional Exam Duration: 2 Hrs					**End Exam Duration: 3 Hrs**			

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

CO1:	Understand raster-based spatial analysis techniques, including query, overlay, and cost- distance analysis.
CO2:	Analyze vector-based spatial analysis techniques such as topology, overlay, and proximity analysis.
CO3:	Apply network analysis techniques for geocoding, shortest path analysis, and location- allocation problems.
CO4:	Evaluate surface and geostatistical analysis methods, including terrain modeling, watershed analysis, and spatial interpolation.
CO5:	Assess GIS customization, WebGIS, and mobile mapping techniques for real-world applications.

UNIT – I

Raster Analysis

Raster Data Exploration: Query Analysis - Local Operations: Map Algebra, Reclassification, Logical and Arithmetic Overlay Operations—Neighborhood - Operations: Aggregation, Filtering- Zonal Operations-Statistical Analysis–Cost- Distance Analysis-Least Cost Path.

UNIT – II

Vector Analysis

Non-Topological Analysis: Attribute Database Query, Structured Query Language, Co-Ordinate Transformation, Summary Statistics, Calculation of Area, Perimeter and Distance

Topological Analysis: Reclassification, Aggregation, Overlay Analysis: Point-In-Polygon, Line- In-Polygon, Polygon-On-Polygon: Clip, Erase, Identity, Union, Intersection – Proximity Analysis: Buffering.

UNIT – III

Network Analysis: Network – Introduction - Network Data Model – Elements of Network - Building A Network Database - Geocoding – Address Matching - Shortest Path inA Network – Time and Distance Based Shortest Path Analysis – Driving Directions – Closest Facility Analysis – Catchment / Service Area Analysis-Location-Allocation Analysis.

UNIT – IV

Surface And Geostatistical Analysis: Surface Data – Sources of X,Y, Z Data – DEM, TIN – Terrain Analysis – Slope, Aspect, Viewshed, Watershed Analysis: Watershed Boundary, Flow Direction, Flow Accumulation, Drainage Network, Spatial Interpolation: IDW, Spline, Kriging, Variogram

UNIT – V

Customisation, Webgis, Mobile Mapping:

Customisation of Gis: Need, Uses, Scripting Languages –Embedded Scripts

Web Gis: Web Gis Architecture, Advantages Of Web Gis, Web Applications-

Location Based Services: Emergency And Business Solutions.

Text Books:

1.	Kang – Tsung Chang, Introduction to Geographical Information System, 4th Ed., Tata McGraw Hill Edition, 2008
2.	Lo, C.P. andYeung, Albert K.W., Concepts and Techniques of Geographic Information Systems Prentice Hall, 2002.

Reference Books:

1.	Michael N. Demers, Fundamentals of Geographic Information Systems, Wiley,2009
2.	Ian Heywood, Sarah Cornelius, Steve Carver, Srinivasaraju, ―An Introduction to Geographical Information Systems, Pearson Education, 2nd Edition, 2007.
3.	John Peter Wilson, The Handbook of Geographic Information Science, Blackwell Pub.,2008

Online Learning Resources:

1.	https://archive.nptel.ac.in/courses/105/105/105105202/
2.	https://onlinecourses.nptel.ac.in/noc19_cs76/preview

Question Paper Pattern:

Sessional Exam: The question paper for Sessional Examination shall be for 40 marks. The question paper shall consist of Four questions and all questions are compulsory. Question No.1 shall contain Five compulsory short answer questions for a total of Ten marks. Question No.2 to 4 shall be EITHER/OR Type for Ten marks each. Student shall Answer any one of them. Each of these questions may contain sub-questions.

End Examination: The question paper for End Examination shall be for 70 marks. The Question paper shall contain Six Questions and all questions are compulsory. Question No.1 shall contain Ten compulsory short answer questions for a total of Twenty marks (with Two short answer questions from each unit). Question No.2 to 6 shall be EITHER/OR Type for Ten marks each and shall cover one Unit of the Syllabus for each question. Student shall Answer any one of them. Each of these questions may contain sub-questions.

SOLID WASTE MANAGEMENT (SWM)							
VII Semester: All Branches						Scheme: **2023**	
Course Code	Category	Hours/Week			Credits	Maximum Marks		
OE716	OE-IV	L	T	P	C	Continuous Internal Assessment	End Exam	TOTAL
		3	0	0	3	30	70	100
Sessional Exam Duration: 2 Hrs					**End Exam Duration: 3 Hrs**			

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

CO1:	Understand the types, sources, and characteristics of solid waste, along with regulatory frameworks.
CO2:	Analyze engineering systems for solid waste collection, storage, and transportation.
CO3:	Apply resource and energy recovery techniques for sustainable solid waste management.
CO4:	Evaluate landfill design, construction, and environmental impact mitigation strategies
CO5:	Assess hazardous waste management techniques, including biomedical and e-waste

UNIT – I

Solid Waste: Definitions, Types of Solid Wastes, Sources of Solid Wastes, Characteristics, and Perspectives; Properties of Solid Wastes, Sampling of Solid Wastes ,Elements of Solid Waste Management-Integrated Solid Waste Management, Solid Waste Management Rules 2016

UNIT – II

Engineering Systems for Solid Waste Management: Solid Waste Generation; On-Site Handling, Storage and Processing; Collection of Solid Wastes; Stationary Container System and Hauled Container Systems – Route Planning- Transfer and Transport; Processing Techniques;

UNIT – III

Engineering Systems for Resource and Energy Recovery: Processing Techniques; Materials Recovery Systems; Recovery of Biological Conversion Products–Composting, Preand Post Processing, Types of Composting, Critical Parameters, Problems With Composing - Recovery of Thermal Conversion Products; Pyrolisis, Gasification, RDF - Recovery of Energy From Conversion Products; Materials and Energy Recovery Systems.

UNIT – IV

Landfills: Evolution of Landfills – Types and Construction of Landfills – Design Considerations – Life of Landfills- Landfill Problems – Lining of Landfills –Types of Liners – Leachate Pollution and Control – Monitoring Landfills – Landfills Reclamation.

UNIT – V

Hazardous Waste Management: Sources and Characteristics, Effects On Environment, Risk Assessment – Disposal of Hazardous Wastes – Secured Landfills, Incineration - Monitoring – Biomedical Waste Disposal, E-Waste Management, Nuclear Wastes, Industrial Waste Management.

Text Books:

1. Tchobanoglous G, Theisen Hand Vigil SA, Integrated Solid Waste Management, Engineering Principles and Management Issues, McGraw Hill, 1993.

2. Vesilind PA, Worrell W and Reinhart D, Solid Waste Engineering' Brooks/Cole Thomson Learning Inc., 2002.

Reference Books:
1. Peavy, H.S, Rowe, D.R., and G. Tchobanoglous, Environmental Engineering', McGraw Hill Inc., New York, 1985.
2. Qian X, Koerner RM and Gray DH, _Geotechnical Aspects of Landfill Design and Construction' Prentice Hall, 2002.

Online Learning Resources:
1. https://archive.nptel.ac.in/courses/105/103/105103205/
2. https://archive.nptel.ac.in/courses/120/108/120108005/

Question Paper Pattern:

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End Examination: The question paper for End Examination shall be for 70 marks. The Question paper shall contain Six Questions and all questions are compulsory. Question No.1 shall contain Ten compulsory short answer questions for a total of Twenty marks (with Two short answer questions from each unit). Question No.2 to 6 shall be EITHER/OR Type for Ten marks each and shall cover one Unit of the Syllabus for each question. Student shall Answer any one of them. Each of these questions may contain sub-questions.

ELECTRIC VEHICLES (EV)							
VII Semester: All Branches Except EEE						**Scheme: 2023**	
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
OE717	OE-IV	**L**	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exam**	**TOTAL**
		3	0	0	3	30	70	100
Sessional Exam Duration: 2 Hrs					**End Exam Duration: 3 Hrs**		

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

CO1:	Understand and differentiate between Conventional Vehicle and Electric Vehicles, electro mobility and environmental issues of EVs.
CO2:	Understand Various dynamics of Electric Vehicles.
CO3:	Remember and understand various configurations in parameters of EV system and dynamic aspects of EV.
CO4:	Analyze fuel cell technologies in EV and HEV systems
CO5:	Analyze the battery charging and controls required of EVs.

UNIT – I

Introduction to EV Systems and Energy Sources: Past, Present and Future of EV - EV Concept- EV Technology- State-of-the Art of EVs- EV configuration- EV system- Fixed and Variable gearing- Single and multiple motor drive- In-wheel drives- EV parameters: Weight, size, force and energy, performance parameters. Electro mobility and the environment- History of Electric power trains- Carbon emissions from fuels- Green houses and pollutants- Comparison of conventional, battery, hybrid and fuel cell electric systems.

UNIT – II

EV Propulsion and Dynamics: Choice of electric propulsion system- Block diagram- Concept of EV Motors- Single and multi- motor configurations- Fixed and variable geared transmission- In-wheel motor configuration- Classification - Electric motors used in current vehicle applications - Recent EV Motors- Vehicle load factors- Vehicle acceleration.

UNIT – III

Fuel Cells: Introduction of fuel cells- Basic operation- Model - Voltage, power and efficiency- Power plant system – Characteristics- Sizing - Example of fuel cell electric vehicle - Introduction to HEV- Brake specific fuel consumption - Comparison of Series-Parallel hybrid systems- Examples.

UNIT – IV

Battery Charging and Control

Battery Charging: Basic requirements- Charger architecture- Charger functions- Wireless charging- Power factor correction.

Control: Introduction- Modeling of electro mechanical system- Feedback controller design approach- PI controller's designing- Torque-loop, Speed control loop compensation- Acceleration of battery electric vehicle.

UNIT – V

Energy Storage Technologies: Role of Energy Storage Systems- Thermal- Mechanical- Chemical- Electrochemical- Electrical - Efficiency of energy storage systems- Super Capacitors-Superconducting Magnetic Energy Storage (SMES)- SOC- SoH -fuel cells - G2V- V2G- Energy storage in Micro-grid and Smart grid- Energy Management with storage systems- Battery SCADA

Text Books:	
1.	C.C Chan, K.T Chau: Modern Electric Vehicle Technology, Oxford University Press Inc., New York 2001,1st Edition.
2.	Ali Emadi, "Advanced Electric Drive Vehicles", CRC Press, 2017,1st Edition.
Reference Books:	
1.	Electric and Hybrid Vehicles Design Fundamentals, Iqbal Husain, CRC Press 2021, 3rd Edition.
2.	Francisco Díaz-González, Andreas Sumper, Oriol Gomis-Bellmunt, "Energy Storage in Power Systems" Wiley Publication, ISBN: 978-1-118-97130-7, Mar 2016,1st Edition.
3.	A.G.Ter-Gazarian, "Energy Storage for Power Systems", the Institution of Engineering and Technology (IET) Publication, UK, (ISBN – 978-1-84919-219-4), Second Edition, 2011.
4.	Mehrdad Ehsani, Yimi Gao, Sebastian E. Gay, Ali Emadi, "Modern Elelctric, Hybrid Elelctric and Fuel Cell Vehicles: Fundamentals, Theory and Design", CRC Press, 2004,1st Edition.
5.	James Larminie, John Lowry, "Electric Vehicle Technology Explained", Wiley, 2003,2nd Edition.
Online Learning Resources:	
1.	https://nptel.ac.in/courses/108/102/108102121/
2.	https://nptel.ac.in/syllabus/108103009
Question Paper Pattern:	

Sessional Exam: The question paper for Sessional Examination shall be for 40 marks. The question paper shall consist of Four questions and all questions are compulsory. Question No.1 shall contain Five compulsory short answer questions for a total of Ten marks. Question No.2 to 4 shall be EITHER/OR Type for Ten marks each. Student shall Answer any one of them. Each of these questions may contain sub-questions.

End Examination: The question paper for End Examination shall be for 70 marks. The Question paper shall contain Six Questions and all questions are compulsory. Question No.1 shall contain Ten compulsory short answer questions for a total of Twenty marks (with Two short answer questions from each unit). Question No.2 to 6 shall be EITHER/OR Type for Ten marks each and shall cover one Unit of the Syllabus for each question. Student shall Answer any one of them. Each of these questions may contain sub-questions.

TOTAL QUALITY MANAGEMENT (TQM)							
VII Semester: All Branches Except ME						Scheme: **2023**	
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
OE718	**OE-IV**	**L**	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exam**	**TOTAL**
		3	0	0	3	30	70	100
Sessional Exam Duration: 2 Hrs					**End Exam Duration: 3 Hrs**			

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

CO1:	Understand the basic concepts and evolution of TQM ; Professional ethics and quality costs
CO2:	Understand the concepts of leadership, quality council, strategic planning and communications
CO3:	Apply the methods to improve costumers satisfactions
CO4:	Analyse motivational aspects of employees and functioning of teams
CO5:	Apply TQM tools like P-D-S-A cycle, Benchmarking, FMEA towards achieving TQM objectives

UNIT – I

Quality: Definition; Dimensions of Quality

Total Quality Management (TQM): Definition; basic concepts of / basic approach to TQM; Benefits of TQM, Barriers / Obstacles to TQM implementation; Evolution of TQM

Ethics: Route causes for unethical behaviour; Ethics Management Program

Quality costs

UNIT – II

Leadership: Characteristics of quality leaders; Leadership concepts; Stephen R. Covey's 7 habits of highly effective people; The Deming's philosophy (14 principles)

Quality Council: Composition; Duties of Quality Council

Quality Statements: The Vision and the Mission statements

Seven steps to Strategic Planning

Communications: Interactive and Formal

UNIT – III

Customer Satisfaction: Customer Satisfaction and its importance; Customer perception of quality; Methods to improve customer satisfaction; Customer Feedback; Handling the customer complaints; Service Quality; Customer Retention

UNIT – IV

Employee Involvement

Motivation: Maslow's hierarchy of needs; Achieving a motivated workforce, Employee empowerment

Teams: Characteristics of successful teams; Roles of team members; Common barriers to team progress; Suggestion system; Recognition and Reward; Gain sharing; Benefits of employee involvement

UNIT – V

TQM Tools

The Problem solving method and P-D-S-A cycle

Benchmarking: Reasons to Benchmark; Process of Benchmarking

Failure Modes and Effects Analysis (FMEA): Benefits; Stages of FMEA; Adapting FMEA to service sector
Pareto diagram; Cause and Effects diagram; Scatter diagram

Text Books:

1. Dale H Besterfield, Total Quality Management, Fourth Edition, Pearson Education, 2015.

2. Subburaj Ramaswamy, Total Quality Management, Tata Mcgraw Hill Publishing Company Ltd., 2005.

3. Joel E.Ross , Total Quality Management, Third Eition, CRC Press, 2017.

Reference Books:

1. Narayana V and Sreenivasan N.S, Quality Management – Concepts and Tasks, New Age International, 1996.

2. Robert L.Flood, Beyond TQM, First Edition, John Wiley & Sons Ltd, 1993.

3. Samuel Ho , TQM – An Integrated Approach, Kogan Page Ltd, USA, 1995

Online Learning Resources

1. https://www.youtube.com/watch?v=VD6tXadibk0
2. https://www.investopedia.com/terms/t/total-quality-management-tqm.asp
3. https://blog.capterra.com/what-is-total-quality-management/
4. https://nptel.ac.in/courses/110/104/110104080/
5. https://onlinecourses.nptel.ac.in/noc21_mg03/preview
6. https://nptel.ac.in/courses/110/104/110104085/
7. https://nptel.ac.in/noc/courses/noc18/SEM2/noc18-mg39/

Question Paper Pattern:

Sessional Exam: The question paper for Sessional Examination shall be for 40 marks. The question paper shall consist of Four questions and all questions are compulsory. Question No.1 shall contain Five compulsory short answer questions for a total of Ten marks. Question No.2 to 4 shall be EITHER/OR Type for Ten marks each. Student shall Answer any one of them. Each of these questions may contain sub-questions.

End Examination: The question paper for End Examination shall be for 70 marks. The Question paper shall contain Six Questions and all questions are compulsory. Question No.1 shall contain Ten compulsory short answer questions for a total of Twenty marks (with Two short answer questions from each unit). Question No.2 to 6 shall be EITHER/OR Type for Ten marks each and shall cover one Unit of the Syllabus for each question. Student shall Answer any one of them. Each of these questions may contain sub-questions.

SAFETY IN ENGINEERING INDUSTRY (SEI)							
VII Semester: All Branches						**Scheme: 2023**	
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
OE719	**OE-IV**	**L**	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exam**	**TOTAL**
		3	**0**	**0**	**3**	**30**	**70**	**100**
Sessional Exam Duration: 2 Hrs					**End Exam Duration: 3 Hrs**			

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

CO1:	Understand the principles of safety management including safety audit, safety education and accident investigation.
CO2:	Understand the causes and implication of fire and explosion and the preventive measures
CO3:	Understand machine and construction safety assessment and safeguarding methods
CO4:	Understand the effect of toxic substances and hazardous chemicals
CO5:	Understand the modes of electrical hazards and safety measures in electrical and information technology industries

UNIT – I

Safety in Engineering Industry: Safety need, General hazards and control measures in engineering industry, Four significant industrial disasters happened in the world (Bhopal, Chernobyl, Flixborough and Rana plaza), Safety audit procedure.

Accident Investigation: Learning from accident, Layered investigations, Investigation process and summary.

UNIT – II

Fire Safety: The fire triangle, Explosions, Distinction between fire and explosions, Flammability characteristics of liquids and vapours, Fire protection techniques, Fire extinguishers, Fire hazard and analysis, Prevention of fire, Steps after occurrence of fire, Fire detection, Fire alarm and firefighting systems, Explosion proof equipment and instruments.

UNIT – III

Machine Safety: Machine guarding, Machine guarding assessment, Safeguarding machines and equipment, Guards, Safeguarding devices, Other potential safeguards.

Construction Safety: Scope, Safety in - Underground works, Above ground works, Under waterworks, Demolition works.

UNIT – IV

Chemical Safety: Hazardous chemicals, Definition of a hazardous chemical, Toxic effects, Working with toxins, Storing hazardous chemicals, Process hazards, Transportation of hazardous chemicals, Chemical waste management, Hazardous chemical emergency procedures, Worker contamination, Chemicals and worker health.

UNIT – V

Electrical Safety: Electrical dangers, Electrical pathways, Static electricity, Result of electrical contact, Shock versus electrocution, Electrical burns, Handling electrical hazards, Controlling electrical hazards, Training, Safety and Health program.

IT Industry Safety: Hazardous in IT industry, General precautions, Employer's responsibility, Employees responsibilities, Office ergonomics, Computer workstation – health & safety tips, Laptop safety precautions.

Text Books:
1. L M Deshmukh, Industrial Safety and Management, McGraw Hill Education (India)
2. D A Crowl and J F Louvar, Chemical Process Safety (Fundamentals with Applications), Prentice Hall, 2011.
3. Charles D Reese, Industrial Safety and Health for People-oriented Services, CRC Press, 2008.
4. M P Poonia and S C Sharma. Industrial Safety and Maintenance Management, Khanna Book Publishing, 2019.
Reference Books:
1. Charles Reese, Industrial Safety and Health for Infrastructure Services, CRC Press, 2009
2. R K Jain and Sunil S Rao, Industrial Safety and Health and Environment Management Systems, Khanna Book Publishing, 2000.
3. K U Mistry, Fundamentals of Industrial safety and Health, Siddharth Prakashan Publisher, 2008.
Online Learning Resources
1. https://archive.nptel.ac.in/courses/110/105/110105094/
Question Paper Pattern:
Sessional Exam: The question paper for Sessional Examination shall be for 40 marks. The question paper shall consist of Four questions and all questions are compulsory. Question No.1 shall contain Five compulsory short answer questions for a total of Ten marks. Question No.2 to 4 shall be EITHER/OR Type for Ten marks each. Student shall Answer any one of them. Each of these questions may contain sub-questions. **End Examination:** The question paper for End Examination shall be for 70 marks. The Question paper shall contain Six Questions and all questions are compulsory. Question No.1 shall contain Ten compulsory short answer questions for a total of Twenty marks (with Two short answer questions from each unit). Question No.2 to 6 shall be EITHER/OR Type for Ten marks each and shall cover one Unit of the Syllabus for each question. Student shall Answer any one of them. Each of these questions may contain sub-questions.

TRANSDUCERS AND SENSORS (T&S)							
VII Semester: All Branches Except ECE						**Scheme: 2023**	
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exam**	**TOTAL**
OE720	**OE-IV**	3	0	0	3	30	70	100
Sessional Exam Duration: 2 Hrs					**End Exam Duration: 3 Hrs**			

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

CO1:	Understand characteristics of Instrumentation System and the operating principle of motion transducers.
CO2:	Explore working principles, and applications of different temperature transducers and Piezo-electric sensors
CO3:	Gain knowledge on flow transducers and their applications.
CO4:	Learn the working principles of pressure transducers.
CO5:	Understand the working principle and applications of force and sound transducers.

UNIT – I

Introduction: General Configuration and Functional Description of measuring instruments, Static and Dynamic Characteristics of Instrumentation System, Errors in Instrumentation System, Active and Passive Transducers and their Classification.

Motion Transducers: Resistive strain gauge, LVDT, RVDT, Capacitive transducers, Piezo-electric transducers, seismic displacement pick-ups, vibrometers and accelerometers

UNIT – II

Temperature Transducers: Standards and calibration, fluid expansion and metal expansion type transducers - bimetallic strip, Thermometer, Thermistor, RTD, Thermocouple and their characteristics.

Hall effect transducers, Digital transducers, Proximity devices, Bio-sensors, Smart sensors, Piezo-electric sensors.

UNIT – III

Flow Transducers: Bernoulli's principle and continuity, Orifice plate, Nozzle plate, Venture tube, Rotameter, Anemometers, Electromagnetic flow meter, Impeller meter and Turbid flow meter.

UNIT – IV

Pressure Transducers: Standards and calibration, different types of manometers, elastic transducers, diaphragm bellows, bourdon tube, capacitive and resistive pressure transducers, high and low pressure measurement.

UNIT – V

Force and Sound Transducers: Proving ring, hydraulic and pneumatic load cell, dynamometer and gyroscopes. Sound level meter, sound characteristics, Microphone.

Text Books:

1. A.K. Sawhney, A course in Electrical and Electronics Measurements and Instrumentation‖, Dhanpat Rai& Co. 3rd edition Delhi, 2010.

2. Rangan C.S, Sarma G.R and Mani V S V, Instrumentation Devices and Systems‖, TATA McGraw Hill publications, 2007.

Reference Books:

1. Doebelin. E.O, ―Measurement Systems Application and Design‖, McGraw Hill

	International, New York, 2004.
2.	Nakra B.Cand Chaudhary K.K , ―Instrumentation Measurement and Analysisǁ, Second Edition, Tata McGraw-Hill Publication Ltd.2006.

Question Paper Pattern:

Sessional Exam: The question paper for Sessional Examination shall be for 40 marks. The question paper shall consist of Four questions and all questions are compulsory. Question No.1 shall contain Five compulsory short answer questions for a total of Ten marks. Question No.2 to 4 shall be EITHER/OR Type for Ten marks each. Student shall Answer any one of them. Each of these questions may contain sub-questions.

End Examination: The question paper for End Examination shall be for 70 marks. The Question paper shall contain Six Questions and all questions are compulsory. Question No.1 shall contain Ten compulsory short answer questions for a total of Twenty marks (with Two short answer questions from each unit). Question No.2 to 6 shall be EITHER/OR Type for Ten marks each and shall cover one Unit of the Syllabus for each question. Student shall Answer any one of them. Each of these questions may contain sub-questions.

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DRONE TECHNOLOGY (DT)							
VII Semester: All Branches						**Scheme: 2023**	
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exam**	**TOTAL**
OE721	**OE-IV**	3	0	0	3	30	70	100
Sessional Exam Duration: 2 Hrs					**End Exam Duration: 3 Hrs**			

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

CO1:	Understand the historical development of unmanned aerial vehicles
CO2:	Understand different drone parts and their contribution for successful flight operation
CO3:	Identify the battery to be used for UAV application.
CO4:	Understand work in go f motor that can be used in UAV.
CO5:	Classify different microcontrollers and flight controllers.

<div align="center">UNIT – I</div>

Introduction to Drones and Their Applications: Definition of drones, history of drones, Structural classification of drones: - fixed wing structure, lighter than air systems, rotary wings aircraft and applications of drones.

<div align="center">UNIT – II</div>

Components of Drones: classifications of drone structures and their suitability, applications and uses of drone frame materials, classifications and applicability of propeller motors, drone materials, design parameters for propellers, composition and structuring of Electronic speed controller, flight control board, characteristics of FCB and their structure.

<div align="center">UNIT – III</div>

Battery and its Management: Introduction of Battery, Description of Li-Po Battery, Charging / Discharging of Battery. Back up, Ratings, Shelf Life, Maintenance and safety of Battery. Selection criteria of Battery for Drone application

<div align="center">UNIT – IV</div>

Sensors: Wi-Fi devices, RADAR and range finder, GPS receiver, Gyro sensor, Speed and Distance sensor, Image sensor, TOF sensor, Chemical sensor. Cameras in drones and selection criteria Of camera for different range. Barometers, Accelerometer, Magnetometer, remote control for drone.

Motors: Difference between AC and DC motors and stepper motor, Brushed and Brushless motors, brief idea of motor capabilities for a drone build. Selection criterion of motor for drone application. Working and application of BLDC motor

<div align="center">UNIT – V</div>

Connections and Interfaces of Devices in Drone: Brief introduction of RS232, RS422, RS485, UART ports. Different types of connectors and their specifications. Microcontroller interfacing techniques.

Introduction to Drone Programming: Introduction to programming language used in drone: C and Python. Installation of cards. Auto Pilot software i.e. Ardupilot, Openpilot

Text Books:

1.	Terry Kil by and Belinda Kil by, "Make: Getting Started with Drones", Maker Media, Inc, 2016
2.	Vasilis Tzivaras, "Buildinga Quadcopter with Arduino", Packt Publishing, 2016

3.	Donald Norris, "Build Your Own Quadcopter - Power Up Your Designs with the Parallax Elev - 8", McGraw – Hill Education, 2014

Reference Books:

1.	Baichtal, "Building Your Own Drones: A Beginners' Guide to Drones, UAVs, and ROVs", Que Publishing, 2016.
2.	Austin, Unmanned Aircraft Systems: UAVS Design, Development and Deployment. Wiley, 2010.
3.	Sebbane, Smart Autonomous Aircraft: Flight Control and Planning for UAV. CRCPress,2015
4.	Zavrsnik, Drones and Unmanned Aerial Systems: Legal and Social Implications for Security and Surveillance. Springer, 2015.

Online Learning Resources:

1.	https://www.dronezon.com/learn-about-drones-quadcopters/
2.	http://ardupilot.org/copter/docs/advanced-multicopter-design.html

Question Paper Pattern:

Sessional Exam: The question paper for Sessional Examination shall be for 40 marks. The question paper shall consist of Four questions and all questions are compulsory. Question No.1 shall contain Five compulsory short answer questions for a total of Ten marks. Question No.2 to 4 shall be EITHER/OR Type for Ten marks each. Student shall Answer any one of them. Each of these questions may contain sub-questions.

End Examination: The question paper for End Examination shall be for 70 marks. The Question paper shall contain Six Questions and all questions are compulsory. Question No.1 shall contain Ten compulsory short answer questions for a total of Twenty marks (with Two short answer questions from each unit). Question No.2 to 6 shall be EITHER/OR Type for Ten marks each and shall cover one Unit of the Syllabus for each question. Student shall Answer any one of them. Each of these questions may contain sub-questions.

INTRODUCTION TO COMPUTER NETWORKS (ICN)							
VII Semester: CE, EEE, ME and ECE						Scheme: **2023**	
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exam**	**TOTAL**
OE722	**OE-IV**	**3**	**0**	**0**	**3**	**30**	**70**	**100**
Sessional Exam Duration: 2 Hrs					**End Exam Duration: 3 Hrs**			

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

CO1:	Describe the architecture of the Internet, reference models, and explain different types of transmission media used in networking.
CO2:	Apply error detection and correction techniques and analyze data link layer protocols and LAN technologies.
CO3:	Explain routing algorithms and the structure of the network layer, including internetworking
CO4:	Analyze the working of transport layer protocols like TCP and UDP, including concepts of connection management and congestion control.
CO5:	Explain the principles of network applications and describe the functionality of protocols such as HTTP, SMTP, DNS, and peer-to-peer systems, including multimedia streaming and content delivery networks.

UNIT – I

Computer Networks and the Internet: What Is the Internet? The Network Edge, The Network Core, Delay, Loss, and Throughput in Packet Switched Networks, Reference Models, Example Networks, Guided Transmission Media, Wireless Transmission

UNIT – II

The Data Link Layer, Access Networks, and LANs: Data Link Layer Design Issues, Error Detection and Correction, Elementary Data Link Protocols, Sliding Window Protocols , Introduction to the Link Layer, Error-Detection and Correction Techniques, Multiple Access Links and Protocols, Switched Local Area Networks

Link Virtualization: A Network as a Link Layer, Data Center Networking, Retrospective: A Day in the Life of a Web Page Request

UNIT – III

The Network Layer: Routing Algorithms, Internetworking, The Network Layer in The Internet

UNIT – IV

The Transport Layer: Connectionless Transport: UDP , The Internet Transport Protocols: TCP, Congestion Control

UNIT – V

Principles of Network Applications: Principles of Network Applications, The Web and HTTP, Electronic Mail in the Internet, DNS—The Internet's Directory Service, Peer-to-Peer Applications Video Streaming and Content Distribution Networks

Text Books:

1. Andrew S.Tanenbaum, David j.wetherall, Computer Networks, 5th Edition, PEARSON.

2. James F. Kurose, Keith W. Ross, ―Computer Networking: A Top-Down Approach‖, 6thedition, Pearson, 2019.

Reference Books:

1. Forouzan, Datacommunications and Networking, 5th Edition, McGraw Hill Publication

2.	Youlu Zheng, Shakil Akthar, Networks for Computer Scientists and Engineers, Oxford Publishers, 2016.

Online Learning Resources:

1. https://nptel.ac.in/courses/106/105/106105183
2. https://gaia.cs.umass.edu/kurose_ross/interactive/
3. https://www.netacad.com/courses/packet-tracer
4. https://www.geeksforgeeks.org/computer-network-tutorials/

Question Paper Pattern:

Sessional Exam: The question paper for Sessional Examination shall be for 40 marks. The question paper shall consist of Four questions and all questions are compulsory. Question No.1 shall contain Five compulsory short answer questions for a total of Ten marks. Question No.2 to 4 shall be EITHER/OR Type for Ten marks each. Student shall Answer any one of them. Each of these questions may contain sub-questions.

End Examination: The question paper for End Examination shall be for 70 marks. The Question paper shall contain Six Questions and all questions are compulsory. Question No.1 shall contain Ten compulsory short answer questions for a total of Twenty marks (with Two short answer questions from each unit). Question No.2 to 6 shall be EITHER/OR Type for Ten marks each and shall cover one Unit of the Syllabus for each question. Student shall Answer any one of them. Each of these questions may contain sub-questions.

INTERNET OF THINGS (IOT)							
VII Semester: CE, EEE, ME and ECE						**Scheme: 2023**	
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
OE723	**OE-IV**	**L**	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exam**	**TOTAL**
		3	**0**	**0**	**3**	**30**	**70**	**100**
Sessional Exam Duration: 2 Hrs						**End Exam Duration: 3 Hrs**		

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

CO1:	Understand general concepts of Internet of Things.
CO2:	Apply design concept to IoT solutions.
CO3:	Analyze various M2M and IoT architectures.
CO4:	Evaluate design issues in IoT applications.
CO5:	Create IoT solutions using sensors, actuators and Devices.

UNIT – I

Introduction to IoT: Definition and Characteristics of IoT, physical design of IoT, IoT protocols, IoT communication models, IoT Communication APIs, , Embedded Systems.

UNIT – II

Prototyping IoT Objects using Microprocessor/Microcontroller: Working principles of sensors and actuators, setting up the board – Programming for IoT, Reading from Sensors. Communication: communication through Bluetooth, Wi-Fi.

UNIT – III

IoT Architecture and Protocols: Architecture Reference Model- Introduction, , IoT reference Model, Protocols- 6LowPAN, RPL, CoAP, MQTT, IoT frameworks- Thing Speak

UNIT – IV

Device Discovery and Cloud Services for IoT: Device discovery capabilities- Registering a device, Deregister a device, Introduction to Cloud Storage models and communication APIs Web-Server, Web server for IoT.

UNIT – V

UAV IoT : Introduction to Unmanned Aerial Vehicles/Drones, Drone Types, Applications: Defense, Civil, Environmental Monitoring; UAV elements and sensors- Arms, motors, Electronic Speed Controller(ESC), GPS, IMU, Ultra sonic sensors; UAV Software – Arudpilot, Mission Planner, Internet of Drones(IoD)- Case study Flyt Base**.**

Text Books:

1. Vijay Madisetti and Arshdeep Bahga, ─ Internet of Things (A Hands-on-Approach), 1st Edition, VPT, 2014.
2. Handbook of unmanned aerial vehicles, K Valavanis; George J Vachtsevanos, New York, Springer, Boston, Massachusetts : Credo Reference, 2014. 2016..

Reference Books:

1. Jan Holler, VlasiosTsiatsis, Catherine Mulligan, Stefan Avesand, Stamatis Karnouskos, David Boyle, ─ From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence‖, 1st Edition, Academic Press, 2014.
2. The Internet of Things, Enabling technologies and use cases – Pethuru Raj, Anupama C. Raman, CRC Press.
3. Francis daCosta, ─Rethinking the Internet of Things: A Scalable Approach to Connecting Everything‖, 1st Edition, Apress Publications, 2013

4.	Cuno Pfister, Getting Started with the Internet of Things, O"Reilly Media, 2011, ISBN: 9781-4493- 9357-1
5.	DGCA RPAS Guidance Manual, Revision 3 – 2020
6.	Building Your Own Drones: A Beginners' Guide to Drones, UAVs, and ROVs, John Baichtal

Online Learning Resources:

1.	https://www.arduino.cc/
2.	https://www.raspberrypi.org/
3.	https://nptel.ac.in/courses/106105166/5
4.	https://nptel.ac.in/courses/108108098/4

Question Paper Pattern:

Sessional Exam: The question paper for Sessional Examination shall be for 40 marks. The question paper shall consist of Four questions and all questions are compulsory. Question No.1 shall contain Five compulsory short answer questions for a total of Ten marks. Question No.2 to 4 shall be EITHER/OR Type for Ten marks each. Student shall Answer any one of them. Each of these questions may contain sub-questions.

End Examination: The question paper for End Examination shall be for 70 marks. The Question paper shall contain Six Questions and all questions are compulsory. Question No.1 shall contain Ten compulsory short answer questions for a total of Twenty marks (with Two short answer questions from each unit). Question No.2 to 6 shall be EITHER/OR Type for Ten marks each and shall cover one Unit of the Syllabus for each question. Student shall Answer any one of them. Each of these questions may contain sub-questions.

MULTIMEDIA & ANNIMATION (MMA)							
VII Semester: All Branches						**Scheme: 2023**	
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
OE724	OE-IV	**L**	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exam**	**TOTAL**
		3	**0**	**0**	**3**	**30**	**70**	**100**
Sessional Exam Duration: 2 Hrs					**End Exam Duration: 3 Hrs**		

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

CO1:	Understand the basic components of a multimedia project.
CO2:	Understand the usage of text and formats in multimedia.
CO3:	Understand the audio digitization, audio file format and audio software.
CO4:	Understand the colour, image, image formats and Correction in multimedia.
CO5:	Understand the digital video standards, formats and basic principles behind animation and Techniques.

UNIT – I

Introduction to Multimedia: What is multimedia, Components of multimedia, Web and Internet multimedia applications, Transition from conventional media to digital media.

UNIT – II

Computer Fonts and Hypertext: Usage of text in Multimedia, Families and faces of fonts, outline fonts, bitmap fonts, International character sets and hypertext, Digital fonts techniques.

UNIT – III

Audio fundamentals and representations: Digitization of sound, frequency and bandwidth, decibel system, data rate, audio file format, Sound synthesis, MIDI, wavetable, Compression and transmission of audio on Internet, Adding sound to your multimedia project, Audio software and hardware.

UNIT – IV

Image fundamentals and representations: Colour Science, Colour, Colour Models, Colour palettes, Dithering, 2D Graphics.

Image Compression and File Formats: GIF, JPEG, JPEG 2000, PNG, TIFF, EXIF, PS, PDF, Basic Image Processing, Use of image editing software, White balance correction, Dynamic range correction, Gamma correction, Photo Retouching.

UNIT – V

Video and Animation: Video Basics, How Video Works, Broadcast Video Standards, Analog video, Digital video, Video Recording and Tape formats, Shooting and Editing Video, Video Compression and File Formats. Video compression based on motion compensation, MPEG-1, MPEG-2, MPEG-4, MPEG-7, MPEG-21, Animation: Cell Animation, Computer Animation, Morphing.

Text Books:

1. Tay Vaughan, "Multimedia making it work", Tata McGraw-Hill, 2008.
2. Rajneesh Aggarwal & B. B Tiwari, " Multimedia Systems", Excel Publication, New Delhi, 2007.
3. Li & Drew, " Fundamentals of Multimedia" , Pearson Education, 2009

Reference Books:

1. Parekh Ranjan, "Principles of Multimedia", Tata McGraw-Hill, 2007

2.	Anirban Mukhopadhyay and Arup Chattopadhyay, "Introduction to Computer Graphics and Multimedia", Second Edition, Vikas Publishing House.

Online Learning Resources:

1. https://www.wisdomjobs.com/e-university/multimedia-tutorial-270.html
2. http://www.multimediatrainingvideos.com/
3. https://www.tutpad.com/tag/multimedia

Question Paper Pattern:

Sessional Exam: The question paper for Sessional Examination shall be for 40 marks. The question paper shall consist of Four questions and all questions are compulsory. Question No.1 shall contain Five compulsory short answer questions for a total of Ten marks. Question No.2 to 4 shall be EITHER/OR Type for Ten marks each. Student shall Answer any one of them. Each of these questions may contain sub-questions.

End Examination: The question paper for End Examination shall be for 70 marks. The Question paper shall contain Six Questions and all questions are compulsory. Question No.1 shall contain Ten compulsory short answer questions for a total of Twenty marks (with Two short answer questions from each unit). Question No.2 to 6 shall be EITHER/OR Type for Ten marks each and shall cover one Unit of the Syllabus for each question. Student shall Answer any one of them. Each of these questions may contain sub-questions.

ADVANCED INFORMATION SYSTEMS (AIS)							
VII Semester: CE, EEE, ME and ECE					Scheme: 2023		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
OE725	OE-IV	L	T	P	C	Continuous Internal Assessment	End Exam	TOTAL
		3	0	0	3	30	70	100
Sessional Exam Duration: 2 Hrs					End Exam Duration: 3 Hrs			

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

CO1:	Demonstrate the Object oriented concepts.
CO2:	Interpret different types of Inheritance and Polymorphism.
CO3:	Classify layer functionalities of OSI reference model and TCP Protocol suite.
CO4:	Summarize the concepts of internetworking, security and IP addressing.
CO5:	Demonstrate different types of protocols and web contents used in web design

UNIT – I

Introduction to Object Oriented Concepts: Introduction, Programming Techniques, Introduction to Object Oriented Concepts, Concept of Structured Procedural Programming, Class, Object

Characteristics of Objects: Data Abstraction, Classification, Encapsulation and Message Passing. Access Specifiers in Class, UML Class Diagrams.

UNIT – II

Advanced Concepts in Object Oriented Technology: Relationships, Inheritance- Protected Access Specifier, Multiple and Multilevel Inheritance, Generalization and Specialization, Abstract classes, Polymorphism, Implementation of OOC through C++.

UNIT – III

Introduction to Computer Networks: Introduction, Network Topology, OSI Reference Model, TCP Protocol Suite, Routing Devices, Types of Networks.

UNIT – IV

Internetworking: Protocols for Internetworking, Internet Address and Domains, Packets, Packet Switched Networks, Virtual Private Networks, and Working of Internet.

UNIT – V

Introduction to Web Technology: Introduction, Hyper Text Transfer Protocol (HTTP), File Transfer Protocol (FTP), Domain Name Server (DNS), Web Applications, Types of Web Content, Multi-Tier Web Applications, Performance of Web Applications.

Text Books:

1.	Campus Connect Foundation Programme – Object Oriented Concepts – System
2.	Campus Connect Foundation Programme – Computer Hardware and System Software - Vol. – 3, INFOSYS Concepts

Reference Books:

1.	Campus Connect Foundation Programme – Relational Database Management System,Client Server

Online Learning Resources:

1.	https://www.tutorialspoint.com/cplusplus/
2.	https://www.geeksforgeeks.org/computer-network-tutorials/

Question Paper Pattern:

Sessional Exam: The question paper for Sessional Examination shall be for 40 marks. The question paper shall consist of Four questions and all questions are compulsory. Question No.1 shall contain Five compulsory short answer questions for a total of Ten marks. Question No.2 to 4 shall be EITHER/OR Type for Ten marks each. Student shall Answer any one of them. Each of these questions may contain sub-questions.

End Examination: The question paper for End Examination shall be for 70 marks. The Question paper shall contain Six Questions and all questions are compulsory. Question No.1 shall contain Ten compulsory short answer questions for a total of Twenty marks (with Two short answer questions from each unit). Question No.2 to 6 shall be EITHER/OR Type for Ten marks each and shall cover one Unit of the Syllabus for each question. Student shall Answer any one of them. Each of these questions may contain sub-questions.

QUANTUM COMPUTING (QC)							
VII Semester: All Branches							**Scheme: 2023**
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exam**	**TOTAL**
OE726	**OE-IV**							
		3	**0**	**0**	**3**	**30**	**70**	**100**
Sessional Exam Duration: 2 Hrs					**End Exam Duration: 3 Hrs**			

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

CO1:	Explain the fundamental concepts of quantum mechanics used in computing.
CO2:	Construct and analyze quantum circuits using standard gates.
CO3:	Apply quantum algorithms like Deutsch-Jozsa, Grover's, and Shor's.
CO4:	Develop simple quantum programs using Qiskit or similar platforms.
CO5:	Analyze applications and challenges of quantum computing in real-world domains.

UNIT – I

Fundamentals of Quantum Mechanics and Linear Algebra: Classical vs Quantum Computation, Complex Numbers, Vectors, and Matrices, Hilbert Spaces and Dirac Notation, Quantum States and Qubits, Superposition and Measurement, Tensor Products and Multi-Qubit Systems.

UNIT – II

Quantum Gates and Circuits: Quantum Logic Gates: Pauli, Hadamard, Phase, Controlled Gates and CNOT, Unitary Operations and Reversibility, Quantum Circuit Representation, Quantum Teleportation, Simulation of Quantum Circuits.

UNIT – III

Quantum Algorithms and Complexity: Quantum Parallelism and Interference, Deutsch and Deutsch-Jozsa Algorithms, Grover's Search Algorithm, Shor's Factoring Algorithm, Quantum Fourier Transform, Complexity Classes: BQP, P, NP, and QMA.

UNIT – IV

Quantum Programming and Simulation Platforms: Introduction to Qiskit and IBM Quantum Experience, Writing Quantum Circuits in Qiskit, Measuring Qubits and Results, Classical-Quantum Hybrid Programs, Noisy Intermediate-Scale Quantum (NISQ) Systems, Limitations and Current State of Quantum Hardware.

UNIT – V

Applications and Future of Quantum Computing: Quantum Machine Learning: Basics and Models, Quantum Cryptography and Quantum Key Distribution, Quantum Algorithms in AI and Optimization, Quantum Advantage and Supremacy, Ethical and Societal Impact of Quantum Technologies, Future Trends and Research Directions.

Text Books:

1. Michael A Nielsen, Isaac L Chuang, Quantum Computation and Quantum Information, Cambridge University Press, 10th Anniversary Edition, 2010.
2. Eleanor Rieffel and Wolfgang Polak, Quantum Computing: A Gentle Introduction, MIT Press, 2011.
3. Chris Bernhardt, Quantum Computing for Everyone, MIT Press, 2019.

Reference Books:

1. David McMahon, Quantum Computing Explained, Wiley, 2008.
2. Phillip Kaye, Raymond Laflamme and Michele Mosca, An Introduction to Quantum

	Computing, Oxford University Press, 2007.
3.	Scott Aaronson, Quantum Computing Since Democritus, Cambridge University Press, 2013.

Question Paper Pattern:

Sessional Exam: The question paper for Sessional Examination shall be for 40 marks. The question paper shall consist of Four questions and all questions are compulsory. Question No.1 shall contain Five compulsory short answer questions for a total of Ten marks. Question No.2 to 4 shall be EITHER/OR Type for Ten marks each. Student shall Answer any one of them. Each of these questions may contain sub-questions.

End Examination: The question paper for End Examination shall be for 70 marks. The Question paper shall contain Six Questions and all questions are compulsory. Question No.1 shall contain Ten compulsory short answer questions for a total of Twenty marks (with Two short answer questions from each unit). Question No.2 to 6 shall be EITHER/OR Type for Ten marks each and shall cover one Unit of the Syllabus for each question. Student shall Answer any one of them. Each of these questions may contain sub-questions.

FINANCIAL MATHEMATICS (FM)							
VII Semester: All Branches						**Scheme: 2023**	
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
OE727	OE-IV	**L**	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exam**	**TOTAL**
		3	0	0	3	30	70	100
Sessional Exam Duration: 2 Hrs					**End Exam Duration: 3 Hrs**			

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

CO1:	Explain fundamental financial concepts, including arbitrage, valuation, and risk.
CO2:	Apply stochastic models, including Brownian motion and Stochastic Differential Equations (SDEs), in financial contexts..
CO3:	Analyze mathematical techniques for pricing options and financial derivatives.
CO4:	Evaluate interest rate models and bond pricing methodologies.
CO5:	Utilize computational techniques such as Monte Carlo simulations for financial modeling.

UNIT – I

Asset Pricing and Risk Management: Fundamental financial concepts: Returns, arbitrage, valuation, and pricing. Asset/Liability management, investment income, capital budgeting, and contingent cash flows. One-period model: Securities, payoffs, and the no-arbitrage principle. Option contracts: Speculation and hedging strategies, CAP Model, Efficient market hypothesis.

UNIT – II

Stochastic Models in Finance: Random Walks and Brownian Motion. Introduction to Stochastic Differential Equations (SDEs): Drift and diffusion. Ito calculus: Ito's Lemma, Ito Integral, and Ito Isometry.

UNIT – III

Interest Rate and Credit Modelling: Interest rate models and bond markets. Short-rate models: Vasicek, Cox-Ingersoll-Ross (CIR),Hull & White models, Credit risk modelling: Hazard function and hazard rate.

UNIT – IV

Fixed-Income Securities and Bond Pricing: Characteristics of fixed-income products: Yield, duration, and convexity. Yield curves, forward rates, and zero-coupon bonds. Stochastic interest rate models and bond pricing PDE. Yield curve fitting and calibration techniques, Mortgage Backed Securities.

UNIT – V

Exotic Options and Computational Finance: Stochastic volatility models and the Feynman-Kac theorem. Exotic options: Barriers, Asians, and Look backs. Monte Carlo methods for derivative pricing, Black-Scholes-Merton model: Derivation and applications.

Text Books:

1. Ales Cerny, Mathematical Techniques in Finance: Tools for Incomplete Markets, Princeton University Press.

2. S.R. Pliska, Introduction to Mathematical Finance: Discrete-Time Models, Cambridge University Press.

Reference Books:

1. Ioannis Karatzas& Steven E. Shreve, Methods of Mathematical Finance, Springer, New York.

2. John C. Hull, Options, Futures, and Other Derivatives, Pearson.
Question Paper Pattern:
Sessional Exam: The question paper for Sessional Examination shall be for 40 marks. The question paper shall consist of Four questions and all questions are compulsory. Question No.1 shall contain Five compulsory short answer questions for a total of Ten marks. Question No.2 to 4 shall be EITHER/OR Type for Ten marks each. Student shall Answer any one of them. Each of these questions may contain sub-questions.   **End Examination:** The question paper for End Examination shall be for 70 marks. The Question paper shall contain Six Questions and all questions are compulsory. Question No.1 shall contain Ten compulsory short answer questions for a total of Twenty marks (with Two short answer questions from each unit). Question No.2 to 6 shall be EITHER/OR Type for Ten marks each and shall cover one Unit of the Syllabus for each question. Student shall Answer any one of them. Each of these questions may contain sub-questions.

SENSORS AND ACTUATORS FOR ENGINEERING APPLICATIONS (SAEA)							
VII Semester: All Branches						**Scheme: 2023**	
Course Code	Category	Hours/Week			Credits	Maximum Marks		
OE728	OE-IV	L	T	P	C	Continuous Internal Assessment	End Exam	TOTAL
		3	0	0	3	30	70	100
Sessional Exam Duration: 2 Hrs					**End Exam Duration: 3 Hrs**		

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

CO1:	To provide exposure to various kinds of sensors and actuators and their engineering applications.
CO2:	To impart knowledge on the basic laws and phenomenon behind the working of sensors and actuators
CO3:	To explain the operating principles of various sensors and actuators
CO4:	To educate the fabrication of sensors
CO5:	To explain the required sensor and actuator for interdisciplinary application

UNIT – I

Introduction to Sensors and Actuators

Sensors: Types of sensors: temperature, pressure, strain, active and passive sensors, General characteristics of sensors (Principles only), Deposition: Chemical Vapor Deposition, Pattern: photolithography and Etching: Dry and Wet Etching.

Actuators: Functional diagram of actuators, Types of actuators and their basic principle of working: Pneumatic, Electromagnetic, Piezo-electric and Piezo-resistive actuators, Applications of Actuators.

UNIT – II

Temperature and Mechanical Sensors

TemperatureSensors: Typesoftemperaturesensorsandtheirbasicprincipleofworking:Thermo-resistive sensors: Thermistors, Thermo-electric sensors: Thermocouples, PN junction temperature sensors

Mechanical Sensors: Types of Mechanical sensors and their basic principle of working: Force sensors: Strain gauges, Tactile sensors, Pressure sensors: Piezoresistive, Variable Reluctance Sensor (VRP).

UNIT – III

Optical and Acoustic Sensors

Optical Sensors: Basic principle and working of: Photodiodes, Phototransistors and Photo resistors based sensors, Photomultipliers, Infrared sensors: thermal, Passive Infra-Red, Fiber based sensors and Thermopiles

Acoustic Sensors: Principle and working of Ultrasonicsensors, Piezo-electricresonators, Microphones

UNIT – IV

Magnetic and Electromagnetic Sensors: Motors as actuators (linear, rotational, stepping motors), magnetic valves, inductive sensors (LVDT, RVDT, and Proximity), Hall Effect sensors, Magneto-resistive sensors, Magnetostrictive sensors and actuators.

UNIT – V

Chemical and Radiation Sensors

Chemical Sensors: Principle and working of Electro-chemical, Thermo-chemical, Gas, pH,

Humidity and moisture sensors.
Radiation Sensors: Principle and working of Ionization detectors, Scintillation detectors, Semiconductor radiation detectors and Microwave sensors (resonant, reflection, transmission)

Text Books:	
1.	Sensors andActuators– Clarence W.deSilva, CRC Press, 2nd Edition, 2015
2.	Sensors andActuators, D.A. Halland C.E.Millar, CRC Press, 1999

Reference Books:	
1.	Sensors and Transducers-D.Patranabhis,Prentice Hall of India(Pvt)Ltd.2003
2.	Measurement, Instrumentation, and Sensors Handbook John G.Webster, CRC Press 1999
3.	Sensors–A Comprehensive Sensors-Henry Bolte, John Wiley.
4.	Hand book of modern sensors, Springer, Stefan Johann Rupitsch

Question Paper Pattern:
Sessional Exam: The question paper for Sessional Examination shall be for 40 marks. The question paper shall consist of Four questions and all questions are compulsory. Question No.1 shall contain Five compulsory short answer questions for a total of Ten marks. Question No.2 to 4 shall be EITHER/OR Type for Ten marks each. Student shall Answer any one of them. Each of these questions may contain sub-questions.
End Examination: The question paper for End Examination shall be for 70 marks. The Question paper shall contain Six Questions and all questions are compulsory. Question No.1 shall contain Ten compulsory short answer questions for a total of Twenty marks (with Two short answer questions from each unit). Question No.2 to 6 shall be EITHER/OR Type for Ten marks each and shall cover one Unit of the Syllabus for each question. Student shall Answer any one of them. Each of these questions may contain sub-questions.

CHEMISTRY OF NANO MATERIALS AND APPLICATIONS (CNMA)							
VII Semester: All Branches							**Scheme: 2023**
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**	
OE729	**OE-IV**	**L**	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exam**	**TOTAL**
		3	**0**	**0**	**3**	**30**	**70**	**100**
Sessional Exam Duration: 2 Hrs						**End Exam Duration: 3 Hrs**	

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

CO1:	Classify the nano structur ematerials; describe scope of nano science and importance of technology.
CO2:	Describe the top-down approach, Explain aerosol synthesis and plasma arc technique, Differentiate chemical vapor deposition method and electrode position method, Discuss about high energy ball milling.
CO3:	Discuss different technique for characterization of nano material, Explain electron Microscopy techniques for characterization of nano material, Describe BET method for surface area analysis.
CO4:	Explain synthesis and properties and applications of nanao materials, Discuss about fullerenes and carbon nano tubes, Differentiate nano magnetic materials and thermo electric materials, nonlinear optical materials.
CO5:	Illustrate advance engineering applications of Water treatment, sensors, electronic devices, medical domain, civil engineering, chemical engineering, metallurgy and mechanical engineering, food science, agriculture, pollutants degradation.

UNIT – I

Basics and Characterization of Nano materials: Introduction, Scope of nano science and nano technology, nano science in nature, classification of nano structured materials, importance of nano materials.

UNIT – II

Synthesis of Nano Materials: Top-Down approach, Inert gas condensation, arc discharge method, aerosol synthesis, plasma arc technique, ion sputtering, laser ablation, laser pyrolysis, and chemical vapour deposition method, electro deposition method, high energy ball milling method.

Synthetic Methods: Bottom-Up approach, Sol-gel synthesis, micro emulsions orrever semicelles, co-precipitation method, solvo thermal synthesis, hydrothermal synthesis, microwave heating synthesis and sonochemical synthesis

UNIT – III

Techniques for Characterization: Diffraction technique, spectroscopy techniques, electron microscopy techniques for the characterization of nanomaterials, BET method for surface area analysis, dynamic light scattering for particle size determination

UNIT – IV

Studies of Nano-structured Materials: Synthesis, properties and applications of the following nanomaterials -fullerenes, carbon nanotubes, 2D-nanomaterial (Graphene), core-shell, magnetic nanoparticles, thermoelectric materials, non-linear optical materials.

UNIT – V

Advanced Engineering Applications of Nanomaterials: Applications ofNano Particle, nanorods, nano wires, Water treatment, sensors, electronic devices, medical domain, civil engineering, chemical engineering, metallurgy and mechanical engineering, food science, agriculture, pollutants degradation

Text Books:	
1.	NANO: The Essentials: T Pradeep, MaGraw-Hill, 2007.
2.	Textbook of Nanoscience and nanotechnology: B S Murty, P Shankar, Baldev Rai, B B Rath and James Murday, Univ. Press, 2012.
Reference Books:	
1.	Concepts of Nanochemistry; Ludovico Cademrtiri and Geoffrey A. Ozin & Geoffrey A. Ozin, Wiley-VCH, 2011.
2.	Nanostructures &Nanomaterials; Synthesis, Properties & Applications: Guozhong Cao, Imperial College Press, 2007.
Question Paper Pattern:	

Sessional Exam: The question paper for Sessional Examination shall be for 40 marks. The question paper shall consist of Four questions and all questions are compulsory. Question No.1 shall contain Five compulsory short answer questions for a total of Ten marks. Question No.2 to 4 shall be EITHER/OR Type for Ten marks each. Student shall Answer any one of them. Each of these questions may contain sub-questions.

End Examination: The question paper for End Examination shall be for 70 marks. The Question paper shall contain Six Questions and all questions are compulsory. Question No.1 shall contain Ten compulsory short answer questions for a total of Twenty marks (with Two short answer questions from each unit). Question No.2 to 6 shall be EITHER/OR Type for Ten marks each and shall cover one Unit of the Syllabus for each question. Student shall Answer any one of them. Each of these questions may contain sub-questions.

LITERARY VIBES (LB)							
VII Semester: All Branches						Scheme: 2023	
Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	Continuous Internal Assessment	End Exam	TOTAL
OE730	OE-IV	3	0	0	3	30	70	100
Sessional Exam Duration: 2 Hrs						End Exam Duration: 3 Hrs		

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

CO1:	Identify genres, literary techniques and creative uses of language in literary texts.
CO2:	Explain the relevance of themes found in literary texts to contemporary, personal and cultural values and to historical forces
CO3:	Apply knowledge and understanding of literary texts when responding to others' problems and their own and make evidence-based arguments
CO4:	Analyze the underlying meanings of the text by using the elements of literary texts
CO5:	Evaluate their own work and that of others critically
CO6:	Develop as creative, effective, independent and reflective students who are able to make informed choices in process and performance

UNIT – I

Poetry:

1. Ulysses- Alfred Lord Tennyson

2. Ain't I woman?-Sojourner Truth

3. The Second Coming-W.B. Yeats

4. Where the Mind is Without Fear-Rabindranath Tagore

UNIT – II

Drama: Twelfth Night- William Shakespeare

Shakespeare -life and works

1. Plot & sub-plot and Historical background of the play

2. Themes and Criticism

3. Style and literary elements

4. Characters and characterization

UNIT – III

Short Story:

1. The Luncheon - Somerset Maugham

2. The Happy Prince-Oscar Wild

3. Three Questions – Leo Tolstoy

4. Grief –Antony Chekov

UNIT – IV

Prose: Essay and Autobiography

1. My struggle for an Education-Booker T Washington

2. The Essentials of Education-Richard Livingston

3. The story of My Life-Helen Keller

4. Student Mobs-JB Priestly

UNIT – V

Novel: Hard Times- Charles Dickens

1. Charles Dickens-Life and works

2. Plot and Historical background of the novel

3. Themes and criticism

4. Style and literary elements

5. Characters and characterization

Text Books:

1.	Charles Dickens.Hard Times.(Sangam Abridged Texts) Vantage Press, 1983
2.	DENT JC.William Shakespeare. Twelfth Night. Oxford University Press,2016.

Reference Books:

1.	WJ Long.History of English Literature, Rupa Publications India; First Edition (4 October 2015)
2.	RK Kaushik And SC Bhatia. Essays, Short Stories and One Act Plays, Oxford University Press .2018.
3.	Dhanvel, SP. English and Soft Skills, Orient Blackswan,2017.
4.	New Horizon, Pearson publications, New Delhi 2014
5.	Vimala Ramarao, Explorations Volume-II, Prasaranga Bangalore University,2014.
6.	Dev Neira, Anjana & Co. Creative Writing: A Beginner's Manual.Pearson India, 2008.

Online Learning Resources:

1.	https://www.litcharts.com/poetry/alfred-lord-tennyson/ulysses
2.	https://www.litcharts.com/lit/ain-t-i-a-woman/summary-and-analysis
3.	https://englishliterature.education/articles/poetry-analysis/the-second-coming-by-w-b-yeats-critical-analysis-summary-and-line-by-line-explanation/#google_vignette
4.	https://sirjitutorials.com/where-the-mind-is-without-fear-poem-notes-explanation/
5.	https://www.litcharts.com/lit/twelfth-night/themes
6.	https://smartenglishnotes.com/2021/11/28/the-luncheon-summary-characters-themes-and-irony/

Question Paper Pattern:

Sessional Exam: The question paper for Sessional Examination shall be for 40 marks. The question paper shall consist of Four questions and all questions are compulsory. Question No.1 shall contain Five compulsory short answer questions for a total of Ten marks. Question No.2 to 4 shall be EITHER/OR Type for Ten marks each. Student shall Answer any one of them. Each of these questions may contain sub-questions.

End Examination: The question paper for End Examination shall be for 70 marks. The Question paper shall contain Six Questions and all questions are compulsory. Question No.1 shall contain Ten compulsory short answer questions for a total of Twenty marks (with Two short answer questions from each unit). Question No.2 to 6 shall be EITHER/OR Type for Ten marks each and shall cover one Unit of the Syllabus for each question. Student shall Answer any one of them. Each of these questions may contain sub-questions.

List of Management Elective Courses

S. No.	Course Name
1	Industrial Engineering and Management
2	Business Ethics and Corporate Governance
3	E-Business
4	Management Science

INDUSTRIAL ENGINEERING & MANAGEMENT (IEM)							
VII Semester: Mechanical Engineering						**Scheme: 2023**	
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
HSM404	BS & H	**L**	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exam**	**TOTAL**
		2	**0**	**0**	**2**	**30**	**70**	**100**
Sessional Exam Duration: 2 Hrs					**End Exam Duration: 3 Hrs**			

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

CO1:	Understand the industrial engineering concepts to make value-based decisions and learn Industrial acts
CO2:	Understand how to locate plant, draw plant layouts and material handling
CO3:	Apply the method study and work measurement techniques
CO4:	Apply project management technique
CO5:	Understand the concepts of reliability, reliability systems and maintenance

UNIT – I

Management: Introduction to Management, Scientific Management, Decision Making Process.

Personnel Management: Functions of personnel management, Types of training, Job evaluation and Merit rating,

Industrial Acts: Industrial safety, Accidents prevention and control, Factories act, Workmen compensation act, Industrial disputes act

UNIT – II

Plant Location: Factors affecting plant location, Comparison between urban and rural location, Breakeven analysis- Mathematical method, Graphical Method**.**

Plant Layout: Introduction, Types of layouts, merits and demerits, Factors governing the design of layout, Muther's principles of plant layout. principles of materials handling, types of material handling equipment.

UNIT – III

Work Study: Introduction to method study, Steps in method study, Recording techniques- Flow process chart, String diagram; Therbligs, Principles of motion economy**.**

Work Measurement: Stop watch time study, Standard time calculation. Work sampling- procedure, applications, Wages and incentives, types of incentive plans.

UNIT – IV

Project management: Introduction, Rules for drawing network diagram, Project Evaluation & Review Technique (PERT), Event time computations-Earliest expected time and latest allowable time, Slack, Critical Path, Critical Path Method(CPM), Activity time estimates (EST, EFT, LST, LFT) and determination of Total Float, Free Float, Independent float, crashing of network

UNIT – V

Reliability and Maintenance: Reliability, exponential distribution of failure and repair times determination of MTBF and MTTR, reliability models; determination of system reliability, Availability and Maintainability, Types of plant maintenance-preventive and breakdown
Maintenance

Text Books:
1. M. Mahajan, Industrial Engineering and production management, Dhanpatrai & sons, New Delhi
2. S.K. Sharma and SavitaSarma, Industrial Engineering and organization management, SK Kataria & Sons, New Delhi
3. E. BalaGurusamy, Reliability Engineering, Tata McGraw Hill
Reference Books:
1. Banga & Sharma, Industrial Engineering and Management, Khanna Publishers, New Delhi
2. ILO , Introduction to Work Study, Universal Publications, Mumbai
3. V.K. Kapoor, Operations Research, S. Chand Publishers, New Delhi
Question Paper Pattern:

Sessional Exam: The question paper for Sessional Examination shall be for 40 marks. The question paper shall consist of Four questions and all questions are compulsory. Question No.1 shall contain Five compulsory short answer questions for a total of Ten marks. Question No.2 to 4 shall be EITHER/OR Type for Ten marks each. Student shall Answer any one of them. Each of these questions may contain sub-questions.

End Examination: The question paper for End Examination shall be for 70 marks. The Question paper shall contain Six Questions and all questions are compulsory. Question No.1 shall contain Ten compulsory short answer questions for a total of Twenty marks (with Two short answer questions from each unit). Question No.2 to 6 shall be EITHER/OR Type for Ten marks each and shall cover one Unit of the Syllabus for each question. Student shall Answer any one of them. Each of these questions may contain sub-questions.

BUSINESS ETHICS AND CORPORATE GOVERNANCE (BECG)							
VII Semester: Mechanical Engineering					**Scheme: 2023**		
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**	
HSM401	BS & H	L	T	P	C	Continuous Internal Assessment	End Exam	TOTAL
		2	0	0	2	30	70	100
Sessional Exam Duration: 2 Hrs					**End Exam Duration: 3 Hrs**		

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

CO1:	Understand loyalty and ethics identify different ethical frameworks, and analyze ethical challenges in management crises.
CO2:	Understand ethics in management, compare professional vs. technical ethics, and cultivate ethical values personally and organizationally
CO3:	Understand corporate culture, its core elements, and how leadership influences it.
CO4:	Apply law and ethics to analyze fair trade and environmental protection practices.
CO5:	Apply corporate governance codes, analyze stakeholder roles, and implement CSR in India.

UNIT – I

Ethics

Introduction – Meaning– Nature, Scope, significance, Loyalty, and ethical behavior. Value systems - Business Ethics - Types, Characteristics, Factors, Contradictions and Ethical Practices in Management –Corporate Social Responsibility– Issues of Management – Crisis Management

UNIT – II

Ethics in Management

Introduction: Ethics in production, finance, Human resource management and Marketing Management – The Ethical Value System – Universalism, Utilitarianism, Distributive Justice, Social Contracts, Individual Freedom of Choice, Professional Codes; Culture and Ethics – Ethical Values in different Cultures - Culture and Individual Ethics – professional ethics and technical ethics.

UNIT – III

Corporate Culture

Introduction - Meaning, definition, Nature, and significance – Key elements of corporate culture, shared values, beliefs and norms, rituals, symbols and language - Types of corporate culture, hierarchical culture, market driven culture – Organization leadership and corporate culture, leadership styles and their impact on culture, transformational leadership and culture change.

UNIT – IV

Legal Framework

Law and Ethics - Agencies enforcing Ethical Business Behaviour -Legal Impact – Environmental Protection, Fair Trade Practices, legal Compliances, Safeguarding Health and wellbeing of Customers – Corporate law, Securities and financial regulations, corporate governance codes and principles.

UNIT – V

Corporate Governance

Introduction - Meaning– Corporate governance code, transparency & disclosure -Role of auditors, board of directors and shareholders. Global issues, accounting and regulatory

framework – Corporate scams - Committees in India and abroad, corporate social responsibility. BoDs composition, Cadbury Committee – Various committees - Reports-Benefits and Limitations.

Text Books:

1. Murthy CSV: Business Ethics and Corporate Governance, HPH July 2017
2. Bholananth Dutta, S.K.Podder – Corporation Governance, VBH .June 2010

Reference Books:

1. Dr.K.Nirmala, Karunakara Readdy .*Business Ethics and Corporate Governance*, HPH
2. R.Machiraju: *Corporate Governance*, HPH,2013
3. K.Venkataramana, *Corporate Governance*, SHBP.

Online Resources:

1. https://onlinecourses.nptel.ac.in/noc21_mg46/
2. https://archive.nptel.ac.in/courses/110/105/110105138/
3. https://onlinecourses.nptel.ac.in/noc21_mg54/

Question Paper Pattern:

Sessional Exam: The question paper for Sessional Examination shall be for 40 marks. The question paper shall consist of Four questions and all questions are compulsory. Question No.1 shall contain Five compulsory short answer questions for a total of Ten marks. Question No.2 to 4 shall be EITHER/OR Type for Ten marks each. Student shall Answer any one of them. Each of these questions may contain sub-questions.

End Examination: The question paper for End Examination shall be for 70 marks. The Question paper shall contain Six Questions and all questions are compulsory. Question No.1 shall contain Ten compulsory short answer questions for a total of Twenty marks (with Two short answer questions from each unit). Question No.2 to 6 shall be EITHER/OR Type for Ten marks each and shall cover one Unit of the Syllabus for each question. Student shall Answer any one of them. Each of these questions may contain sub-questions.

E-BUSINESS (EBS)							
VII Semester: Mechanical Engineering							**Scheme: 2023**
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exam**	**TOTAL**
HSM402	**BS & H**	**2**	**0**	**0**	**2**	**30**	**70**	**100**
Sessional Exam Duration: 2 Hrs					**End Exam Duration: 3 Hrs**			

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

CO1:	Understand the concept of e-business, compare it with e-commerce, and evaluate its industry opportunities.
CO2:	Understand business models, compare portal types, and analyze B2B, B2C, and B2G models.
CO3:	Analyze electronic payment systems by understanding EFT, smart cards, debit, and credit cards.
CO4:	Evaluate e-security measures by understanding security protocols, public networks, and digital signatures.
CO5:	Apply online marketing concepts and compare e-CRM and e-SCM.

UNIT – I

Electronic Business

Introduction – Nature, meaning, significance, functions, and advantages - Definition of Electronic Business - Functions of Electronic Commerce (EC)-Advantages & Disadvantages of E-Commerce –E-Commerce and E-Business, Internet Services, Online Shopping- E-Commerce Opportunities for Industries.

UNIT – II

Electronic Markets and Business Models

Introduction –E-Shops-E-Malls E-Groceries - Portals - Vertical Portals-Horizontal Portals - Advantages of Portals -Business Models- Business to Business (B2B)-Business to Customers(B2C) - Business to Government(B2G)-Auctions-B2B Portals in India

UNIT – III

Electronic Payment Systems

Introduction to electronic payment systems (EPS) -Types of electronic payments - Credit/debit cards, e-wallets, UPI, and crypto currencies -Smart cards and digital wallets: Features and usage -Electronic Fund Transfer (EFT): Role in business transactions - Infrastructure requirements and regulatory aspects of e-payments

UNIT – IV

E-Security

Security risks and challenges in electronic commerce - Cyber threats - Phishing, hacking, identity theft, and malware - Digital Signatures & Certificates - Security protocols over public networks (HTTP, SSL, TLS) -Firewalls in securing e-business platforms.

UNIT – V

E-Marketing

Introduction – Online Marketing – Advantages of Online Marketing – Internet Advertisement – Advertisement Methods – Conducting Online Market Research–E-marketing planning: Online branding, social media marketing, and email marketing - E-business strategies: Digital advertising, content marketing, and analytics – E-Customer Relationship Management (E-CRM) E-supply chain management (E-SCM)

Text Books:	
1.	Arati Oturkar&Sunil Khilari. E-Business. Everest Publishing House, 2022
2.	P.T.S Joseph. E-Commerce, Fourth Edition, Prentice Hall of India, 2011
Reference Books:	
1.	Debjani, Kamalesh K Bajaj. E-Commerce, Second Edition Tata McGraw-Hill's, 2005
2.	Dave Chaffey.E-Commerce E-Management, Second Edition, Pearson, 2012.
3.	Henry Chan. E-Commerce Fundamentals and Application, RaymondLeathamWiley India 2007.
4.	S. Jaiswal. E-Commerce GalgotiaPublication Pvt Ltd., 2003.
Online Resources:	
1.	https://www.slideshare.net/fatimahAlkreem/e-businessppt-67935771
2.	https://www.slideshare.net/VikramNani/e-commerce-business-models
3.	https://www.slideshare.net/RiteshGoyal/electronic-payment-system
4.	https://www.slideshare.net/WelingkarDLP/electronic-security
5.	https://www.slideshare.net/Ankitha2404/emarketing-ppt
Question Paper Pattern:	

Sessional Exam: The question paper for Sessional Examination shall be for 40 marks. The question paper shall consist of Four questions and all questions are compulsory. Question No.1 shall contain Five compulsory short answer questions for a total of Ten marks. Question No.2 to 4 shall be EITHER/OR Type for Ten marks each. Student shall Answer any one of them. Each of these questions may contain sub-questions.

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MANAGEMENT SCIENCE (MS)							

VII Semester: Mechanical Engineering | **Scheme: 2023**

Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exam**	**TOTAL**
HSM403	BS & H	2	0	0	2	30	70	100

Sessional Exam Duration: 2 Hrs | **End Exam Duration: 3 Hrs**

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

CO1:	Understand core management concepts, theories, organizational structures, and the role of social responsibility for effective management.
CO2:	Understand the essential operations management principles and apply marketing mix strategies in the industry.
CO3:	Understand key HRM concepts and functions and apply these practices to effectively manage the complete employee lifecycle within an organization.
CO4:	Apply SWOT analysis, PERT and CPM techniques to strengthen project strategy formulation
CO5:	Apply the advanced management systems to enhance organizational quality, efficiency, innovation and social responsibility.

UNIT – I

Introduction to Management: Management - Concept and meaning - Nature-Functions - Management as a Science and Art and both. Schools of Management Thought - Taylor's Scientific Theory-Henry Fayols' principles - Elton Mayo's Human relations

Organizational Designs: Line organization - Line & Staff Organization - Functional Organization - Matrix Organization - Project Organization - Committee form of Organization - Social responsibilities of Management.

UNIT – II

Operations Management: Principles and Types of Plant Layout -Methods of Production (Job, batch, and Mass Production), Work Study - Statistical Quality Control

Material Management: Objectives - Inventory- Functions - Types, Inventory Techniques - EOQ-ABC Analysis.

Marketing Management: Concept-Meaning-Nature-FunctionsofMarketing-MarketingMix-ChannelsofDistribution
AdvertisementandSalesPromotion-MarketingStrategiesbasedonProductLife Cycle.

UNIT – III

Human Resources Management (HRM): HRM - Definition and Meaning – Nature - Managerial and Operative functions - Job Analysis - Human Resource Planning(HRP) - Employee Recruitment-Sources of Recruitment - Employee Selection -Process -Employee Training and Development - methods - Performance Appraisal Concept - Methods of Performance Appraisal – Placement - Employee Induction - Wage and Salary Administration

UNIT – IV

Strategic Management: Definition & Meaning - Setting of Vision - Mission - Goals - Corporate Planning Process – Environmental Scanning-Steps in Strategy Formulation and Implementation –SWOT Analysis-

Project Management: Network Analysis - Program Evaluation and Review Technique (PERT) - Critical Path Method (CPM) Identifying Critical Path - Probability of Completing the project within given time - Project Cost- Analysis - Project Crashing (Simple problems).

UNIT – V

Contemporary Issues in Management: Customer Relations Management(CRM) - Total Quality Management (TQM) - Six Sigma Concept - Supply Chain Management(SCM) - Enterprise Resource Planning (ERP) - Performance Management – employee engagement and retention - Business Process Re- engineering and Bench Marking - Knowledge Management – change management – sustainability and corporate social responsibility.

Text Books:

1. Frederick S. Hillier, Mark S. Hillier. Introduction to Management Science, October 26, 2023
2. A.R Aryasri, Management Science, TMH, 2019

Reference Books:

1. Stoner, Freeman, Gilbert. *Management, Pearson* Education, New Delhi, 2019.
2. Koontz &Weihrich, *Essentials ofManagement*,6/e, TMH, 2005.
3. Thomas N.Duening&JohnM.Ivancevich, *Management Principles and Guidelines*, Biztantra
4. Kanishka Bedi, Production and Operations Management, Oxford University Press, 2004.

Online Resources:

1. https://nptel.ac.in/courses/112107238
2. https://archive.nptel.ac.in/courses/110/104/110104068/
3. https://archive.nptel.ac.in/courses/110/105/110105069/
4. https://onlinecourses.nptel.ac.in/noc24_mg112/

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