IEM Salt Lake Campus, IEM Newtown Campus & IEM Jaipur Campus

New Syllabus Outline Structure

For
7th SEMESTER (B.Tech in Mechanical Engineering)

Effective from Academic Year 2025-2026

DEPARTMENT OF MECHANICAL ENGINEERING

Index

University of Engineering and Management

Institute of Engineering & Management, Salt Lake Campus
Institute of Engineering & Management, New Town Campus
University of Engineering & Management, Jaipur
Syllabus for B. Tech Admission Batch 2022-2026

B.Tech M.E. 4th Year 7th Semester

SL NO	Category	Paper Code	Paper Name	L	T	P	Total Contact Hrs	Credits
Theory Papers								
1	PEC	PECME701	Professional Elective -III	3	0	0	3	3
2	OEC	OECME701	Open Elective-I	3	0	0	3	3
3	OEC	OECME702	Open Elective-II	3	0	0	3	3
6	HSMC	HSMME701	HSS/Management Elective-2 (A. Operation Research/ B. Industrial Psychology)	3	0	0	3	3
4	HSMC	ESPME701	Essential Studies for Professionals (ME) - VII	2	0	0	2	0.5
Practical / Sessional Papers								
5	PRJ	PRJME781	Project-V	0	0	5	5	2.5
6	PRJ	PRJME782	Internship	0	0	0	0	4
7	HSMC	SDP781	Skill Development for Professionals - VII	0	0	2	2	0.5
			TOTAL				**23**	**19.5**
For B.Tech Honours Degree								
8	MOOCS	MOOCS	MOOCs Certificate Courses (NPTEL/SWAYAM)	-	-	-	-	-
For B.Tech with Minor Degree in Robotics								
9	MD	MINOR781R	Project in Robotics I	1	0	2	3	2
For B.Tech with Minor Degree in Sustainable Energy Engineering								
10	MD	MINOR701S	Solar Energy Technologies and System Design	1	1	2	3	3
For B.Tech with Minor Degree in Artificial Intelligence and Machine Learning								
11	MD	MINOR701A	Applications of AI	3	0	0	3	3
Mandatory Courses								
12	IFC	IFC	Industry and Foreign Certification (IFC)	0	0	0	0	0
13	MAR	MAR	Mandatory Additional Requirements (MAR)	0	0	0	0	0

List of Professional Electives for Elective-III (Industry) (PECME701)

A. PECME701A Automobile Engineering
B. PECME701B Material Handling
C. PECME701C Industrial Engineering
D. PECME701D Industrial Robotics
E. PECME701E Aerospace Engineering
F. PECME701F Biomedical Engineering
G. PECME701G Agricultural Engineering

List of Open Electives for Open Elective-I (OECME701)

A. OECME701A Principal & Practice of management
B. OECME701B Process Planning and Cost Estimation
C. OECME701C Renewable Energy Engineering

List of Open Electives for Open Elective-II (OECME702)

A. OECME702A Industry 4.0
B. OECME702B Optimization Techniques
C. OECME702C Data Analytics
D.

B.Tech M.E. 7th Semester

Subject Name: Automobile Engineering **Credit: 3**
Subject Code: PECME701A **Lecture Hours: 36**
Pre-requisite: Basic Engineering Knowledge

Relevant Links: STUDY MATERIAL **NPTEL**

Objectives:

- The objective of this subject is to provide knowledge about various systems involved in automobile engine.
- Able to learn about different components of IC Engines.
- Different automobile engine systems line diagrams

Module number	Topic	Sub-topics	Mapping with Industry and International Academia	Lecture Hours	Corresponding Lab Assignment	Mapping with Text Books
1	**Introduction**	History of automobiles; Classification of automobiles; Power plant classification; Engine terminology; Types of cycles; Working principle of an IC engine; Advanced classification of engines and multi cylinder engines; Engine balance and firing order.	***IIT Indor Syllabus:*** https://people.iitism.ac.in/~academics/assets/course_structure/new/cat/mech/mech.pdf ***IIT Delhi Syllabus:*** https://web.iitd.ac.in/~ravimr/curriculum/uic/senate-191/ME-Automotive-Design.pdf ***International Standard:*** https://www.upc.edu/grau/en/386/bachelors-degree-in-automotive-engineering.pdf	3	Determine both the Otto cycle and the Diesel cycle under air-standard assumptions, and plots the P-V and T-S diagrams with MATLAB	Automobile Mechanicss, Dr. N.K. Giri – Chapter 1,2 and 3
2	**Fuel System, Ignition System and Electrical system**	*Spark Ignition engines* – fuel tank, fuel filter, fuel pump, air filter, carburetor, direct injection of petrol engines; *Compression Ignition engines* – fuel injection (air and solid), pressure charging, super charging and turbo charging; *Ignition systems* – components, battery ignition, magneto ignition, electronic ignition and ignition timing; *Main electrical circuits* – generating	***IIT Indor Syllabus:*** https://people.iitism.ac.in/~academics/assets/course_structure/new/cat/mech/mech.pdf ***IIT Delhi Syllabus:*** https://web.iitd.ac.in/~ravimr/curriculum/uic/senate-191/ME-Automotive-Design.pdf ***International Standard:***	4	Simulate air–fuel mixture ratio and analyze performance for (using MATLAB): Carbureted SI engine Direct-injected petrol engine CI engine with solid fuel injection	Automobile Mechanicss, Dr. N.K. Giri – Chapter 4,5,6 and 9

		& starting circuit, lighting, indicating devices.	https://www.upc.edu/grau/en/386/bachelors-degree-in-automotive-engineering.pdf			
3	**Lubricating System and Cooling System**	Functions & properties of lubricants, methods of lubrication; Oil filters, oil pumps, oil coolers; Characteristics of an effective cooling system; types of cooling systems; Radiator, thermostat, air cooling & water cooling.	***IIT Indor Syllabus:*** https://people.iitism.ac.in/~academics/assets/course_structure/new/cat/mech/mech.pdf ***IIT Delhi Syllabus:*** https://web.iitd.ac.in/~ravimr/curriculum/uic/senate-191/ME-Automotive-Design.pdf ***International Standard:*** https://www.upc.edu/grau/en/386/bachelors-degree-in-automotive-engineering.pdf	5	Simulate oil flow and temperature in a pressurized lubrication circuit using MATLAB. Assumptions You CanCustomize **Parameter** / **Default** Pipe Length L / 2 m Diameter D / 10 mm Viscosity mu / 0.15 Pa·s Flow rate Q / 100 ml/s	Automobile Mechanicss, Dr. N.K. Giri – Chapter 7,8
4	**Chassis & Transmission**	Parts of automobile body; *Automobile frames* – functions, constructions, sub frames, materials and defects; *Transmission* – axles, clutches, propeller shafts, differential, gear boxes, automatic transmission, electronic transmission control, functions and types of front and rear axles, types and functions of clutches, Hotchkiss drive	***IIT Indor Syllabus:*** https://people.iitism.ac.in/~academics/assets/course_structure/new/cat/mech/mech.pdf ***IIT Delhi Syllabus:*** https://web.iitd.ac.in/~ravimr/curriculum/uic/senate-191/ME-Automotive-Design.pdf ***International Standard:***	6	Simulate torque transfer and slippage in a dry friction clutch during engagement using MATLAB.	Automobile Mechanicss, Dr. N.K. Giri – Chapter 10, 11,

		torque tube drive, traction control.	https://www.upc.edu/grau/en/386/bachelors-degree-in-automotive-engineering.pdf			
5	**Steering, Braking and Suspension**	Steering mechanism, steering gear box types, wheel geometry; Brakes – principle, functions, types, construction, operation and parking brake; *Suspension* - types of spring shock absorbers, objectives and types of suspension system, rear axle suspension, electronic control and proactive suspension system.	***IIT Indor Syllabus:*** https://people.iitism.ac.in/~academics/assets/course_structure/new/cat/mech/mech.pdf ***IIT Delhi Syllabus:*** https://web.iitd.ac.in/~ravimr/curriculum/uic/senate-191/ME-Automotive-Design.pdf ***International Standard:*** https://www.upc.edu/grau/en/386/bachelors-degree-in-automotive-engineering.pdf	6	Determine front-wheel angles for different turning radii using Ackermann geometry using MATLAB.	Automobile Mechanicss, Dr. N.K. Giri – Chapter 12 and 17
6	**Automotive Air Conditioning**:	Ventilation, heating, air condition, refrigerant, compressor and evaporator.	***IIT Indor Syllabus:*** https://people.iitism.ac.in/~academics/assets/course_structure/new/cat/mech/mech.pdf ***IIT Delhi Syllabus:*** https://web.iitd.ac.in/~ravimr/curriculum/uic/senate-191/ME-Automotive-Design.pdf ***International Standard:*** https://www.upc.edu/grau/en/386/bachelors-de	4	Determine vapor compression refrigeration cycle used in car A/C using MATLAB. **Refrigerant:** R134a or R1234yf	Automobile Mechanicss, Dr. N.K. Giri – Chapter 22

			gree-in-automotive-engineering.pdf			
7	**Wheels and Tyers**	Wheel quality, assembly, types of wheels, wheel rims. Construction of tyres and tyre specifications.	***IIT Indor Syllabus:*** https://people.iitism.ac.in/~academics/assets/course_structure/new/cat/mech/mech.pdf ***IIT Delhi Syllabus:*** https://web.iitd.ac.in/~ravimr/curriculum/uic/senate-191/ME-Automotive-Design.pdf ***International Standard:*** https://www.upc.edu/grau/en/386/bachelors-degree-in-automotive-engineering.pdf	4	Determine vertical tyre deformation under static load using a linear spring model uisng MATLAB.	Automobile Mechanicss, Dr. N.K. Giri – Chapter 13
8	**Recent Trends**	E-vehicles; Satellite-based navigation; Automated steering; Environment effect and mitigation.	***IIT Indor Syllabus:*** https://people.iitism.ac.in/~academics/assets/course_structure/new/cat/mech/mech.pdf ***IIT Delhi Syllabus:*** https://web.iitd.ac.in/~ravimr/curriculum/uic/senate-191/ME-Automotive-Design.pdf ***International Standard:*** https://www.upc.edu/grau/en/386/bachelors-degree-in-automotive-eng	4	Simulate a simple vehicle path-following algorithm using GPS waypoints using MATLAB(Pure Pursuit Path Tracking).	Automobile Mechanicss, Dr. N.K. Giri – Chapter 23

			ineering.pdf			

Text /Reference Books:

1. Dr. N. K. Giri, Automobile Mechanics, Khanna Book Publishing, 2020
2. A.K. Babu, S.C. Sharma, Automobile Mechanics, Khanna Book Publishing, 2019.
3. A.K. Babu, S.C. Sharma, Automobile Engines, Khanna Book Publishing, 2019.
4. Kirpal Singh, Automobile Engineering, 7th ed., Standard Publishers, New Delhi, 1997.
5. Jain K.K. and Asthana R.B., Automobile Engineering, Tata McGraw Hill, New Delhi, 2002.
6. Heitner J., Automotive Mechanics, 2nd ed., East-West Press, 1999.
7. Heisler H., Advanced Engine Technology, SAE International Publ., USA, 1998.

Online Resources:

1. https://archive.nptel.ac.in/courses/107/106/107106088/

Course Outcomes:

At the end of this course students will demonstrate the ability to

CO1	Identify the different parts of the automobile.
CO2	Explain the working of various parts like engine, transmission, clutch, brakes etc.,
CO3	Demonstrate various types of drive systems and analyze the environmental implications of automobile emissions and suggest suitable regulatory modifications.
CO4	Evaluate future developments in the automobile technology

Subject Name: Principles & Practices of Management **Credit: 3**
Subject Code: OECME701 A **Lecture Hours: 36**
Pre-requisite: Basic engineering and management knowledge

Relevant Links: **NPTEL**

Course Objective

1. To impart information on different aspects of management utilised in a given industry.
2. To make familiar about some management decision making systems and motivational aspects usually practiced in an industry.

Module number	Topic	Sub-topics	Mapping with Industry and International Academia	Lecture Hours	Corresponding Assignment Lab Assignment	Mapping with Text Books

1	**Management**	Definition, nature, importance, evolution of management thoughts– pre & post scientific era, contributions made by Taylor, Fayol, Gilbreth, Elton Mayo, McGregor, Maslow– Covering Time & Motion Study, Hawthrone Experiments; Is management a science or art? Functions of manager, ethics in managing and social responsibility of managers.	***IIT Indor Syllabus:*** https://people.iitism.ac.in/~academics/assets/course_structure/new/cat/mech/mech.pdf	5	Refer to Google Classroom	**1.** Anil Bhat, Arya Kumar, Management (Principles, Processes and Practices), Oxford Higher Education **2.** L.M.Prasad, PRINCIPLES AND PRACTICES OF MANAGENENT
2	**Planning & Control**	Why Management process starts with planning, steps in planning, planning premises, types of planning, barriers to effective planning, operational plan, strategic planning, Mckinsey's 7's Approach, SWOT analysis, Controlling- concept, Planning- control relationship, process of control, human response to control, dimensions of control, MBO.	***IIT Indor Syllabus:*** https://people.iitism.ac.in/~academics/assets/course_structure/new/cat/mech/mech.pdf	5		**1.** Anil Bhat, Arya Kumar, Management (Principles, Processes and Practices), Oxford Higher Education **2.** L.M.Prasad, PRINCIPLES AND PRACTICES OF MANAGENENT

3	**Decision Making & Organizing**	Nature, process of decision making, decision making under Certainty and Uncertainty, decision-tree, group-aided decision, brain-storming; Organizing – concept, nature and process of organizing, authority and responsibility, delegation and empowerment, centralization and decentralization, concept of departmentation.	***IIT Indor Syllabus:*** https://people.iitism.ac.in/~academics/assets/course_structure/new/cat/mech/mech.pdf	6	Refer to Google Classroom	**1.** Anil Bhat, Arya Kumar, Management (Principles, Processes and Practices), Oxford Higher Education **2.** L.M.Prasad, Principles and Practices of Managenent
4	**Staffing & Motivation**	Concept, Manpower planning, Job design, recruitment & selection, training and development, performance appraisal, motivation, motivators and satisfaction, motivating towards organizing objectives, morale building.	***IIT Indor Syllabus:*** https://people.iitism.ac.in/~academics/assets/course_structure/new/cat/mech/mech.pdf	5		**1.** Anil Bhat, Arya Kumar, Management (Principles, Processes and Practices), Oxford Higher Education **2.** L.M.Prasad, Principles and Practices of Managenent
5	**Leadership & Communication**	Defining leadership and its role, should managers lead, leadership style, leadership development, Leadership behavior. Communication- Process, Bridging gap-using tools of communication, electronic media in Communication.	***IIT Indor Syllabus:*** https://people.iitism.ac.in/~academics/assets/course_structure/new/cat/mech/mech.pdf	5	Refer to Google Classroom	**1.** Anil Bhat, Arya Kumar, Management (Principles, Processes and Practices), Oxford Higher Education **2.** L.M.Prasad, PRINCIPLES AND PRACTICES OF MANAGENENT

6	**Financial Management**	Financial functions of management, Financial Planning, Management of Working Capital, Sources of	***IIT Indor Syllabus:*** https://people.iitism.ac.in/~academics/assets/course_structure/new/cat/mech/mech.pdf	5	Refer to Google Classroom	**1.** Anil Bhat, Arya Kumar, Management (Principles, Processes and Practices), Oxford Higher Education **2.** L.M.Prasad, Principles and Practices of Managenent
7	**Marketing Management**	Functions of Marketing, Product Planning & Development, Marketing Organization, Sales Organization, Sales Promotion, Consumer Behaviour, Marketing Research and Information.	***IIT Indor Syllabus:*** https://people.iitism.ac.in/~academics/assets/course_structure/new/cat/mech/mech.pdf	5	Refer to Google Classroom	**1.** Anil Bhat, Arya Kumar, Management (Principles, Processes and Practices), Oxford Higher Education **2.** L.M.Prasad, Principles and Practices of Managenent

Text Books:

1. Anil Bhat, Arya Kumar, MANAGEMENT (PRINCIPLES, PROCESSES AND PRACTICES), OXFORD Higher Education
2. L.M.Prasad, PRINCIPLES AND PRACTICES OF MANAGENENT

Reference Books:

1. S. Robbins and M. Culter, Management, Pearson, 2016.
2. J.R. Schermerhorn, Introduction to Management, Wiley India Edition, 2011.
3. C.J. O'Donnel and H. Koontz, Principles of Management, McGrew Hill, 1995.
4. R.L. Daft, New Era of Management, Cengage Learning, 2008.
5. Premvir Kapoor, Principles of Management, Khanna Publishing House, 2019.

Course Outcomes:

At the end of this course students will demonstrate the ability to

CO1	Understand the evolutionary development of management.

CO2	Understand the general principles of management.
CO3	Understand the management functions in an organization
CO4	To provide knowledge on different aspects of management applied in an industry.

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Subject Name: Data Analytics **Credit: 3**

Subject Code: OECME702C **Lecture Hours: 36**

Pre-requisite: Programming Languages

Relevant Links: **STUDY MATERIAL** **COURSERA**

Objectives: The objective of this subject is

- Provide knowledge and expertise to become a proficient data scientist.
- Demonstrate an understanding of statistics and machine learning concepts that are vital for data science;
- Produce Python code to statistically analyse a dataset;
- Critically evaluate data visualisations based on their design and use for communicating stories from data;

Syllabus Content:

Module number	Topic	Sub-topics	Mapping with Industry and International Academia	Lecture Hours	Corresponding Assignment	Mapping with Text Books

1	**Introduction**	Introduction to Data Science, Different Sectors using Data science, Purpose and Components of Python in Data Science.	***AICTE prescribed syllabus:*** https://www.aicte-india.org/sites/default/files/Model%20Curriculum%20for%20Minor%20Degree%20for%20UG%20Degree%20Courses%20in%20Engineering%20&%20Technology.pdf ***International Standard:*** https://professional-education-gl.mit.edu/mit-online-data-science-program	6	**Task 1: Explore a dataset of your choice (e.g., Iris dataset, etc) and perform the following tasks:** 1. Load the dataset using Pandas. 2. Clean and preprocess the data (handle missing values, outliers, etc.). 3. Visualize the data using Matplotlib or Seaborn. 4. Perform statistical analysis (mean, median, mode, etc.) on the data. **Task 2: Build a machine learning model using Scikit-learn to predict a target variable in the dataset. Evaluate the model's performance using metrics such as accuracy, precision, and recall.** **Task 3: Write a short report (2-3 pages) discussing the insights gained from the data analysis and machine learning model. Include visualizations and code snippets to support your findings.**	Data Science from Scratch, Joel Grus– Chapter 1,2
2	**Data Analytics Process**	Data Analytics Process, Knowledge Check, Exploratory Data Analysis (EDA), EDA- Quantitative technique, EDA-	***AICTE prescribed syllabus:*** https://www.aicte-india.org/sites/default/files/Model%20Curriculum%20for%20Minor%20Degree%	8	**Task 1: Perform EDA on a dataset of your choice (e.g., Iris dataset, Titanic dataset) using quantitative and graphical techniques. Include the following:**	

		Graphical Technique, Data Analytics Conclusion and Predictions.	20for%20UG%20Degree%20Courses%20in%20Engineering%20&%20Technology.pdf ***International Standard:*** https://datasciencemajor.stanford.edu/academics/undergraduate-bs-program/bs-degree-requirements-2024-2025		1. Summary statistics (mean, median, mode, standard deviation) 2. Correlation analysis 3. Histograms and scatter plots 4. Box plots **Task 2: Build a regression model to predict a continuous outcome variable in the dataset. Evaluate the model's performance using metrics such as R-squared and mean squared error.** **Task 3: Write a short report (2-3 pages) discussing the insights gained from the EDA and regression analysis. Include visualizations and code snippets to support your findings.**	
3	**Motivating Applications, Feature Generation and Feature Selection algorithms**	Feature Generation and Feature Selection (Extracting Meaning from Data)- Motivating application: user (customer) retention- Feature Generation (brainstorming, role of domain expertise, and place for imagination)- Feature Selection algorithms.	***AICTE prescribed syllabus:*** ***https://www.aicte-india.org/sites/default/files/Model%20Curriculum%20for%20Minor%20Degree%20for%20UG%20Degree%20Courses%20in%20Engineering%20&%20Technology.pdf*** ***International Standard:*** https://datasciencemajor.stanford.edu/academics/undergraduat	8	**Task 1: Brainstorm potential features for a user retention model in a specific industry (e.g., online gaming, e-commerce). Include the following:** 1. User engagement metrics: Features related to user engagement, such as time spent on the platform, number of logins, etc. 2. Usage patterns: Features related to usage patterns, such as frequency of use, time of day, etc. 3. User demographics:	

			e-bs-program/bs-degree-requirements-2024-2025		Features related to user demographics, such as age, location, etc. **Task 2: Implement a feature selection algorithm (e.g., correlation-based feature selection, recursive feature elimination) to select the most relevant features for the user retention model.** **Task 3: Build a machine learning model (e.g., logistic regression, random forest) using the selected features to predict user churn.**	
4	**Data Visualization**	Data Visualization-Basic principles, ideas and tools for data visualization, Examples of inspiring (industry) projects- Exercise: create your own visualization of a complex dataset.	***AICTE prescribed syllabus:*** https://www.aicte-india.org/sites/default/files/Model%20Curriculum%20for%20Minor%20Degree%20for%20UG%20Degree%20Courses%20in%20Engineering%20&%20Technology.pdf ***International Standard:*** https://datasciencemajor.stanford.edu/academics/undergraduate-bs-program/bs-degree-requirements-2024-2025	8	**Task: Create your own visualization of a complex dataset using a tool of your choice (e.g., Matplotlib, Seaborn, Tableau).** Dataset: Choose a complex dataset that interests you, such as: 1. Climate data: Temperature, precipitation, or sea level data. 2. Economic data: GDP, inflation, or unemployment data. 3. Social media data: Twitter or Facebook data.	Data Science from Scratch, Joel Grus– Chapter 3

5	**Applications of Data Science**	Applications of Data Science, Data Science and Ethical Issues- Discussions on privacy, security, ethics- A look back at Data Science- Next-generation data scientists.	***AICTE prescribed syllabus:*** https://www.aicte-india.org/sites/default/files/Model%20Curriculum%20for%20Minor%20Degree%20for%20UG%20Degree%20Courses%20in%20Engineering%20&%20Technology.pdf ***International Standard:*** https://datasciencemajor.stanford.edu/academics/undergraduate-bs-program/bs-degree-requirements-2024-2025	6	**Task: Write a case study on the applications of Data Science in a specific industry (e.g., healthcare, finance).**	Data Science from Scratch, Joel Grus– Chapter 25

Text /Reference Books:

8. Joel Grus, Data Science from Scratch, Shroff Publisher Publisher /O'Reilly Publisher Media.
9. Annalyn Ng, Kenneth Soo, Numsense! Data Science for the Layman, Shroff Publisher Publisher.
10. Cathy O'Neil and Rachel Schutt. Doing Data Science, Straight Talk from The Frontline. O'Reilly Publisher Media.
11. Jure Leskovek, Anand Rajaraman and Jeffrey Ullman. Mining of Massive Datasets. v2.1, Cambridge University Press.
12. Jake VanderPlas, Python Data Science Handbook, Shroff Publisher Publisher /O'Reilly Publisher Media
13. Philipp Janert, Data Analysis with Open Source Tools, Shroff Publisher Publisher /O'Reilly Publisher Media.

Online Resources:

1. https://www.coursera.org/learn/introduction-to-data-analytics

Course Outcomes:

At the end of this course students will be able to

CO1	**Explain** the applications of data science in various sectors and apply Python components to analyze real-world problems and develop data-driven solutions.
CO2	**Interpret** quantitative and graphical techniques in Exploratory Data Analysis (EDA) to conclude the data analytics process, effectively.
CO3	**Evaluate** feature generation and feature selection algorithms to improve model performance for applications like user retention.
CO4	**Apply** basic principles and ideas of data visualization of complex datasets using various tools and techniques.
CO5	**Determine** the applications and ethical implications of data science to develop responsible data-driven solutions and create a vision for next-generation data science practices.

Subject Name: Operation Research **Credit: 3**

Subject Code: HSMME701A **Lecture Hours: 36**

Pre-requisite: Basic Engineering Knowledge

Relevant Links: OR - Study Materials.pdf NPTEL

Objectives:

- To study the various Operations Research tools
- To study to apply an appropriate model to the given situation
- To formulate the problems of Operation research and Supply chain system
- To solve and analyze the problems on Operations Research

University of Engineering and Management

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1	**Introduction to Operations Research:**	Introduction, Historical Background, Scope of Operations Research, Features of Operations Research, Phases of Operations Research, Types of Operations Research Models, Operations Research Methodology, Operations Research Techniques and Tools, Structure of the Mathematical Model, Limitations of Operations Research.	***IIT Roorkee Syllabus:*** IITRoorkee.pdf ***International Standard:*** Philadelphia University OR.pdf	**2**	NA	H.A. Taha, Operations Research - An Introduction, 7th Edition, Prentice Hall, 2002
2	**Linear Programming:**	Introduction, Linear Programming Problem, Requirements of LPP, Mathematical Formulation of LPP, Case Studies of LPP, Graphical Methods to Solve Linear Programming Problems, Applications, Advantages, Limitations. Graphical Analysis of Linear Programming Problems: Introduction, Graphical Analysis, Some Basic Definitions, Graphical Methods to Solve LPP, Some Exceptional Cases, Important Geometric Properties of LPP. Simplex Method: Introduction, Standard Form of LPP, Fundamental theorem of LPP,	***IIT Roorkee Syllabus:*** IITRoorkee.pdf ***International Standard:*** Philadelphia University OR.pdf	**8**	NA	H.A. Taha, Operations Research - An Introduction, 7th Edition, Prentice Hall, 2002

		Solution of LPP - Simplex Method, The Simplex Algorithm, Penalty Cost Method or Big M-method, Two Phase Method, Solved Problems on Minimisation. Duality in Linear Programming Problem: Introduction, Importance of Duality Concepts, Formulation of Dual Problem, Economic Interpretation of Duality, Sensitivity Analysis.				
3	**Transportation Problem:**	Introduction, Formulation of Transportation Problem (TP), Transportation Algorithm (MODI Method), the Initial Basic Feasible Solution, Moving Towards Optimality.	***IIT Roorkee Syllabus:*** IITRoorkee.pdf ***International Standard:*** Philadelphia University OR.pdf	**3**	NA	H.A. Taha, Operations Research - An Introduction, 7th Edition, Prentice Hall, 2002
4	**Assignment Problem:**	Introduction, Mathematical Formulation of the Problem, Hungarian Method Algorithm, Travelling Salesman Problem.	***IIT Roorkee Syllabus:*** IITRoorkee.pdf ***International Standard:*** Philadelphia University OR.pdf	**3**	NA	H.A. Taha, Operations Research - An Introduction, 7th Edition, Prentice Hall, 2002

5	**Project Management Using CPM-PERT:**	Project Scheduling and PERT-CPM: Introduction, Basic Difference between PERT and CPM, PERT/CPM Network Components and Precedence Relationship, Project Management – PERT, Float calculation and its importance. Cost reduction by Crashing of activity.	***IIT Roorkee Syllabus:*** IITRoorkee.pdf ***International Standard:*** Philadelphia University _OR.pdf	**5**	NA	H.A. Taha, Operations Research - An Introduction, 7th Edition, Prentice Hall, 2002
6	**Queuing Theory:**	Basis of Queuing theory, elements of queuing theory, Operating characteristics of a queuing system, Queue discipline, Service Mechanism, Classification of Queuing models, [M/M/1]:{//FCFS} Queue System, numerical.	***IIT Roorkee Syllabus:*** IITRoorkee.pdf ***International Standard:*** Philadelphia University _OR.pdf	**3**	NA	H.A. Taha, Operations Research - An Introduction, 7th Edition, Prentice Hall, 2002
7	**Inventory Management:**	Inventory classification, Different costs associated with Inventory, Inventory models with deterministic demands (EOQ, EPQ and price discount models), inventory classification systems.	***IIT Roorkee Syllabus:*** IITRoorkee.pdf ***International Standard:*** Philadelphia University _OR.pdf	**4**	NA	H.A. Taha, Operations Research - An Introduction, 7th Edition, Prentice Hall, 2002
8	**Job Sequencing:**	Introduction to sequencing and scheduling models: n job two machines problem, n job 3 machines problem.	***IIT Roorkee Syllabus:*** IITRoorkee.pdf ***International***	**2**	NA	H.A. Taha, Operations Research - An Introduction, 7th Edition, Prentice Hall, 2002

			Standard: Philadelphia University OR.pdf			
9	**Decision Theory:**	Introduction, Decision under certainty, Decision under risk, Decision under uncertainty: Laplace criterion, MaxiMin criterion, MiniMax criterion, savage MiniMax regret criterion, Hurwicz criterion, Decision tree.	***IIT Roorkee Syllabus:*** IITRoorkee.pdf ***International Standard:*** Philadelphia University OR.pdf	**3**	NA	H.A. Taha, Operations Research - An Introduction, 7th Edition, Prentice Hall, 2002
10	**Replacement Theory:**	Introduction, Replacement of capital equipment which depreciated with time, replacement by alternative equipment, Group and individual replacement policy.	***IIT Roorkee Syllabus:*** IITRoorkee.pdf ***International Standard:*** Philadelphia University OR.pdf	3	NA	H.A. Taha, Operations Research - An Introduction, 7th Edition, Prentice Hall, 2002

Text /Reference Books:

1. H.A. Taha, Operations Research - An Introduction, 7th Edition, Prentice Hall, 2002.
2. F.S. Hillier, G.J. Lieberman, B. Nag and P. Basu, Introduction to Operation Research, 10th Edition, McGraw Hill, 2017.
3. C. Mohan and K. Deep, Optimization Techniques, New Age, 2009.
4. N.D. Vohra, Quantitative Techniques in Management, 5th Edition, McGraw-Hill.
5. K.V. Mittal and C. Mohan, Optimization Methods in Operations Research and Systems Analysis, New Age, 2003.
6. A. Ravindran, D.T. Phillips and J.J. Solberg, Operations Research: Principles and Practice, 2nd Edition, John Willey and Sons, 2009.
7. K. Bedi, Production and Operations Management, Oxford University Press, 2004.

8. S.J. Chandra and A. Mehra, Numerical Optimization with Applications, Narosa, 2009.
9. J.K. Sharma, Operation Research: Theory and Applications, 5th Edition, Macmillan Pub., 2013.
10. Research Applications and Algorithms, 4th Edition, Brooks/Cole, USA.

Online Resources:

1. https://onlinecourses.nptel.ac.in/noc19_ma29/preview
2. https://onlinecourses.swayam2.ac.in/cec20_ma10/preview

Course Outcomes:

At the end of this course students will demonstrate the ability to

CO1	Develop a model that describes the real-life problem and solve them using optimization technique.
CO2	Use the basic methodology to find the solution of linear problems.
CO3	Introduce the students to the basic concepts of decision science, inventory management and project management.
CO4	To formulate complex mathematical models in management science, industrial engineering and transportation science.

Subject Code: PRJME781	**Category:** Project, Seminar, and Industrial Training
Subject Name: Project-V	**Semester**: Seventh
L-T-P: **0-0-8**	**Credit: 4**
Pre-Requisites: Manufacturing Processes, Manufacturing Technology	

Objectives:

It is intended to start the project work early in the seventh semester and carry out both design and fabrication of a mechanical device whose working can be demonstrated. The design is expected to be completed in the seventh semester and the fabrication and demonstration will be carried out in the eighth semester.

Course Outcomes:

1. Select a suitable research gap through literature to solve the real-life problems faced by the society
2. Understand the concept of simulation through practical work.
3. Present the results from the work comprehensively through presentation and develop a comprehensive report
4. Present his/her work in a conference or publish the work in a peer reviewed journal

Solar Energy Technologies and System Design

Course Code	MINOR701S
Course Title	Solar Energy Technologies and System Design
Number of credits	3[Lecture(15hours):1,Practical(15hours):2,Social(15hours):1]
Course category	SEE
Pre-requisite	None

Course Objective:

This course will offer

- An introduction to various solar PV and solar thermal technologies
- Basic parameters of solar PV panels and systems
- Standard test conditions under which the parameters are measured
- Design of solar PV system for electrical energy requirements, sizing of PV modules, battery, electronics, etc.
- Design of solar thermal system for given thermal energy requirements

Course Content

D. Theoretical Learning

Each lecture is assumed to be of one hour. In content column, if possible breakdown the content of 1 hour in sub-topics

Lecture No.	Contents

1	**Materials for solar energy conversion:** discussion on what are different material categorization, use of semiconductors for converting sunlight into electricity, and use of metals for converting sunlight into heat, basic properties of semiconductors and metals required for conversion, e.g., bandgap, absorption coefficient, solar spectrum and energy of photons
2	**Material parameters:** important material parameters of semiconductors, band gap, absorption coefficient, absorption length, mobility, carrier drift, diffusion coefficient, carrier diffusion, Light absorption and recombination in semiconductors,
3	I-V characterises of P-N junction diode : forward and reverse biasing of P-N junction, forward biased current, reverse bias current, total current of P-N junction, I-V equation and curve
4	**Illuminated P-N Junction as solar cells:** discussion on why P-N junction diode requires power, but solar cell generates power, different quadrant of operations for P-N junction, dark and illuminated behaviour of P-N junction, demonstration through shift in I-V curve, discussion on photovoltaic effect
5	I-V characteristic of solar cells: I-V characteristics of a P-N junction diode under dark (write expression), light illuminated current component, I-V characteristics of a P-N junction diode under illumination, fourth quadrant operation, explain solar cell parameters Voc, Isc, FF, Efficiency using I-V curve, write down expressions
6	**Standard Test Condition and PV module parameters:** discussion on why there is need of STC, Converting solar cells to modules for obtaining required current, voltage and power, STC for solar energy technologies, PV modules parameters, effect of temperature and radiation on output parameters, reasons for variation in actual output of solar PV modules in real-life conditions.
7	**Solar PV technologies (part-I):** discussion on what students have seen in market or real life installations, various material and corresponding PV technologies, thin-film and crystalline Si technologies, commercially available technologies, best efficiencies of solar modules in labs and the commercial market
8	**Solar PV technologies (part-II):** discussion on what students have seen in market or real life installations, various material and corresponding PV technologies, thin-filmand crystalline Si technologies, commercially available technologies, bestefficienciesofsolarmodulesinlabsandcommercialmarket

9	**Typical parameters of c-Si solar cells:** Parameters of commercially produced solar cells and modules, typical values of voltage, current, FF and Efficiency, typical power ratings
10	**Solarthermaltechnologies:** various solar thermal technologies like solar hot water heater, solar cooker, discussion on need of concentration of light for higher temperatures, methods of sunlight concentration, solar concentration for power generation
11	**Design of solar hot water system:** discussion on what should be the solar thermal system components, use of thermosyphon effect, drawing of solar hot water system, estimate the energy required for heating water, estimation of collector area required for delivering required energy, considering typical losses in conversion, efficiency equation of solar thermal system
12	**Design of solar PV system (Part-I):** discussion on what should be the solar PV system components, block diagram of simple (no storage, no electronics) and complicated systems (grid tied with diesel and wind generators), estimating user's electrical energy requirements, sizing solar PV, battery and power conditioning units required in solar system, configuration of battery and panels, fixing input and output parameters of all system components
13	**Design of solar PV system (Part-II):** discussion on what should be the solar PV system components, block diagram of simple (no storage, no electronics) and complicated systems (grid tied with diesel and wind generators), estimating user's electrical energy requirements, sizing solar PV, battery and power conditioning units required in solar system, configuration of battery and panels, fixing input and output parameters of all system components
14	Costing of solar PV system : costing of solar components, per unit costing of panels, batteries, structure, wires, electronics, total system costing
15	Misconception of solar energy generation and Costing of solar system: discussion on what possible misconception people have in mind, generation in rainy season, need of maintenance, high costing of solar PV system, clarifying with data why these are misconception as per current status of technologies, typical costing of solar PV system components on per Watt basis as per current norms, estimating overall system costing, costing of solar thermal systems

E.Practical Learning

Each experiment can be of 2.5 to 3 hours. In the contents, please provide as detailed titles of the experiments as possible, also break down experiments in sub-experiments to give a clear indication of what concepts/observations students are expected to learn in each experiment.

Experiment No.	Contents
Note	Conduct any of the five experiments listed below
1	Take a solar panel and look at it carefully, at looking at it comment and write down various aspects of panel, what materials you see are used, how many solar cells are connected, how they are connected, what is the material used in making solar cells (mono or multi-crystalline or any other), what would be per cell parameters, look at name plate rating, does the name plate rating matches with expected outcome based on solar cell configurations
2	Take a solar panel (any wattage, 10, 20, 50, 100, 250, 300 Watt, etc.) and measure its parameters in real conditions, Voc, Isc, FF, Efficiency, repeat the experiments several times. What are your observation on variation in these parameters when you repeat the experiment at 30 min, interval (take at least 5 readings)
3	Measure the effect of sun tracking on output generation by a solar PV module, measure when module is fixed and when it is following the Sun (adjust the orientation of the panel manually), measure power output at every 30 min interval (take at least 5 readings), estimate the energy generated in two conductions and figure out the difference in energy generated when fixed and when tracking the sun.
4	Measure the energy consumed by few loads in the laboratory like lights, fans on the day of your experiments, use power meter and mustimeter, perform the experiments for at least two hour duration
5	Estimate the energy consumed by all appliances used in a lab on monthly basis, design a solar PV system and size various system components for the same, cross-check if your designed system would generate the required energy

F. Social Learning

This activity is crucial and requires careful design. This includes activities outside the classroom and outside the laboratory. Students must do something to apply their knowledge. This can also be exercise to apply the knowledge learned in classroom and laboratory and

gather more information/data from society on a topic.

Social experiment No.	Contents
Note	Conduct any of the three experiments / exercises
1	Visit any installation of solar PV system or solar thermal system in your institution or any nearby area. Take note of interconnection of various components of system, make a comment on how system is designed
2	Measure energy consumed by some loads in your home, use power meter and energy meter to carry out measurements, check if the measured energy consumption is as per your expectations.
3	Make an energy consumption estimation of all the electrical loads in your house, is your estimation matched with the electricity bill that you are paying?
4	Based on your monthly electricity requirement of your home, design a solar PV system to fulfil your monthly electricity needs, write a design report on the same.
5	Visit a nearby school, college or any other institution, estimate their load or use their electricity bill for energy requirement, and design a solar system for institution

Tools required:

- Solar system components (panels, battery, structure, wires) for a given design
- Cement and concrete
- Measuring tape, installation tools (angle meter, screw driver, spanner, level meter, etc.)

Text books and other references

• PV system design Software
https://www.pvsyst.com/
https://www.homerenergy.com/homer/software
https://solargis.com/
• Solar radiation data of any place across the world https://globalsolaratlas.info/map
• Knowledge Centre, Ministry of New & Renewable Energy - Government of India

https://mnre.gov.in/
• Chapter 03, S. P. Sukhatme and J. K. Nayak, Solar Energy – Principles of Thermal Collection and Storage, Tata McGraw Hill, 2008
• Chapter 01, J. K. Nayak and J. A. Prajapati, Handbook On Energy Conscious Buildings, 2006
• C. S. Solanki, Solar Photovoltaic Technology and Systems: A Manual for Technicians,
Trainers and Engineers, Prentice Hall of India, 2013
• PV Installation Professional Resource Guide – NABCEP
http://www.nabcep.org/wp-content/uploads/2016/10/NABCEP-PV-Resource-Guide-10-4-16-W.pdf
• Photovoltaics: Design and Installation Manual, Solar Energy International (SEI), USA
https://www.solarenergy.org/
Minor Degree in Sustainable Energy Engineering (SEE)
• Guide to the Installation of Photovoltaic Systems, Microgeneration certification scheme
(MCS) (Author), Electrical Contractors' Association (ECA), UK, 2012
https://mcscertified.com/standards-tools-library/

Expected outcome of course:

Possible outcomes of course are ability to:

- Estimate the PV plant capacity for any end user by comparing active site area and annual consumption.
- Design plant SLD and simulate the plant performance ratio in simulation software.
- Understand datasheet of major solar components for selection of efficient, optimized, cost effective component from market.
- Identify, handle and operate various installation tools and tackles.
- Install an On grid and Off Grid Solar PV system.
- Monitor and maintain a solar plant for better energy generation and performance.
- Perform visual inspection, analyze the possible dust formation & requirement of cleaning & its frequency.
- Perform continuity tests and Polarity test & Recognize the danger of leaking current
- Identify & Troubleshoot the faults in the system
- Reading & interpretation of Data Sheets, O&M manual & Prepare a maintenance pla

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University of Engineering and Management

Institute of Engineering & Management, Salt Lake Campus
Institute of Engineering & Management, New Town Campus
University of Engineering & Management, Jaipur
Syllabus for B. Tech Admission Batch 2022-2026

Course Code	MINOR781R
Course Title	Project in Robotics
Number of Credits	4 (L: 1; T: 0; P: 6)
Course Category	Minor Degree

Course Objective:

To assimilate the theoretical knowledge gained in the lecture courses (ROB-1 to 4) for real-life practical applications in order have effective learning and skill-development, mainly, from the point of view of the employability in industries.

Course Contents:

This course is a project type. The plan of conducting this course is given below:

1. Participants will be divided into teams of two/four members within first week of the starting of the course by the course coordinators/managers depending on the number of participants registered in the course. The benefits of such team-based projects are listed in the Course Outcomes below.

2. The teams will have a team coordinator or leader, which will be identified by the coordinators/managers of the course (may be the first name in the list of a student team).

3. The projects could be of the following types:

    a. Literature search (LS) type: Studying about an aspect of robotics, say, vision, robot kinematics, dynamic, controls, etc.

    b. Algorithm development (AD) type: Analyse, say, a robot kinematics using RoboAnalyzer or Matlab/Octave/Freemat/Scilab or similar software or write an algorithm using any programming language (Python, etc.). For example, writing forward kinematics of a robot or image processing in Vision.

    c. Design/synthesis (DS) type: Proposing a new type of system/device for performing certain task. For example, a mobile robot for Covid-19 isolation wards.

4. The teams will be asked to contact their team members within a week and decide their topic with two weeks, i.e., within first 3 weeks of the starting of the course.

5. Students MUST spend about 6 hours in a week to discuss their progress together, study together or individually, write programmes, fabricate circuits, etc.

6. During the one lecture hour the coordinators will explain how to do literature survey, how to find the sources of hardware, which software to use for a particular purpose,
   how to select an electric motor, etc., present case studies, etc.

7. At the end of the course duration, each team will submit no more than 10 slides in .pdf file and/or not more than a video of one min to showcase their project hardware/software/plots, etc. generated during the project to a cloud (say, Google Drive).

8. Evaluation: It will be done in two parts
   a. Peer Evaluations (20%): Presentations in .pdf will be evaluated (online) by two other teams and grade them out of 10 marks.
   b. Expert evaluation (80%): Coordinators will take a presentation of 3 mins. plus, Q&A in a common online session to give marks out of 80.

Text Books/References:

Since it is a project type, some experience sharing books and links to similar activities are listed.

1. Chuhan, M., and Saha, S.K., 2010, Robotics Competition Knowledge Based Eduation in Engineering, Pothi.com
2. Baun, M., and Chaffe, J., 2018, Engineering and Building Robots for Competitions, Amazon.com

Corresponding Online Resources:

1. http://www.ddrobocon.in/
2. http://courses.csail.mit.edu/iap/6.095/

Course Outcomes:

The outcomes are envisaged as follows:

1. Each participant will know students from other colleges/states and their work ethics/culture.
2. To Practice how to work together in a team. An essential skill in an industry.
3. To apply the theoretical knowledge learnt from other courses, which is required by an industry.
4. To learn how to make presentation in a team. A soft skill needed in research and industry.
5. Peer learning from the evaluation of other teams' work. A skill which is essential when one is in a workforce.

6. To examine different hardware components and their working/control using software.

Subject Name: Essential Studies for Professionals (ME) - VII
Subject Code: ESP(ME)701 **Credit: 0.5** **Lecture Hours: 48**

Module number	Topic	Sub-topics	Mapping with International/ National/ State Level Exams	Lecture Hours	Corresponding Assignment
1	**Theory of Machines**	**Textbook: Acing the GATE: Mechanical Engineering by Ajay Kumar Tamrakar, Dinesh Kumar HarurSampath, Publisher Wiley (Chapter 3) Theory of Machines**: Displacement, velocity and acceleration analysis of plane mechanisms; dynamic analysis of linkages; cams; gears and gear trains, flywheels and governors; balancing of reciprocating and rotating masses; gyroscope. Vibrations: Free and forced vibration of single degree of freedom systems, effect of damping; vibration isolation;	*National Exams:* 1. ***GATE:*** ***(https://gate2024.iisc.ac.in/ wp-content/uploads/2023/07/ me.pdf)*** 2. ***UPSC Engineering Service Examination:*** ***(https://upsc.gov.in/sites/default/files/Notif-ESEP-23-engl-140922- Final.pdf), Page-22,23*** 3. ***UPSC Civil Service Examination:*** ***(https://upsc.gov.in/sites/default/files/Notif-CSP-23-engl-010223.pdf), Page- 127- 129*** 4. ***SSC Junior Engineer:***	16	
		resonance; critical speeds of shafts **(Chapter 15) Metrology and Inspection:** Limits, fits and tolerances; linear and angular measurements; comparators;	***(https://ssc.nic.in/SSCFileServer/PortalManagement/UploadedFiles/NOTICE_JE_2023_26072023.pdf)*** 5. ***RRB JE,Technician, & Miscellaneous Category Posts:*** ***(https://wcr.indianrailways***		

		gauge design; interferometry; form and finish measurement; alignment and testing methods; tolerance analysis in manufacturing and assembly.	.gov.in/uploads/files/16584 93303114-english%20GDCE%2002_ 2022.pdf)		
2	**Advance Professional Knowledge**	**(Chapter 5) Machine Design** :Gears, rolling and sliding contact bearings, brakes and clutches, spring **(Chapter 9) Applications:** **A. Power Engineering**: Air and gas compressors; vapour and gas power cycles, concepts of regeneration and reheat. I.C. Engines: Air- standard Otto, Diesel and dual cycles. **B. Refrigeration and air-conditioning:** Vapour and gas refrigeration and heat pump cycles; properties of moist air, psychrometric chart, basic psychrometric processes. **Turbomachinery:** Impulse and reaction principles, velocity diagrams, Pelton- wheel, Francis and Kaplan turbines.	***National Exams:*** ***1. GATE:*** ***(https://gate2024.iisc.ac.in/ wp-content/uploads/2023/07/ me.pdf)*** ***2. UPSC Engineering Service Examination:*** ***(https://upsc.gov.in/sites/default/files/Notif-ESEP-23-engl-140922- Final.pdf), Page-22,23*** ***3. UPSC Civil Service Examination:*** ***(https://upsc.gov.in/sites/default/files/Notif-CSP-23-engl-010223.pdf), Page- 127- 129*** ***4. SSC Junior Engineer:*** ***(https://ssc.nic.in/SSCFileServer/PortalManagement/UploadedFiles/NOTICE_JE_2023_26072023.pdf)*** ***RRB JE,Technician, & Miscellaneous Category Posts:*** ***(https://wcr.indianrailways.gov.in/uploads/files/16584 93303114-english%20GDCE%2002_ 2022.pdf)***	16	
			National Exams: ***1. GATE:*** ***(https://gate2024.iisc.a c.in/wp-***		

	Machining and Machine Tool Operations	**(Chapter 3)** **Theory of Mechanics**: Principle of non-traditional machining Process, principles of work holding, jigs and fixtures; abrasive machining processes; NC/CNC machines and CNC programming. Computer Integrated Manufacturing: Basic concepts of CAD/CAM and their integration tools	*content/uploads/2023/0 7/me.pdf)* 2. ***UPSC Engineering Service Examination:*** *(https://upsc.gov.in/sites/default/files/Notif-ESEP-23-engl-140922- Final.pdf), Page-22,23* 3. ***UPSC Civil Service Examination:*** *(https://upsc.gov.in/sites/default/files/Notif-CSP-23-engl-010223.pdf), Page- 127- 129* 4. ***SSC Junior Engineer:*** *(https://ssc.nic.in/SSCFileServer/PortalManagement/UploadedFiles/NOTICE_JE_2023_26072023.pdf)* 5. ***RRB JE, Technician, & Miscellaneous Category Posts:*** *(https://wcr.indianrailways.gov.in/uploads/files/1658493303114-english%20GDCE%2002_2022.pdf)*	16	

Text Books:

1. G.K publishers GATE Mechanical Engineering,
2. McGraw Hill GATE 2017 Mechanical Engineering,
3. Wiley GATE 2017 Mechanical Engineering

University of Engineering and Management

Institute of Engineering & Management, Salt Lake Campus
Institute of Engineering & Management, New Town Campus
University of Engineering & Management, Jaipur
Syllabus for B. Tech Admission Batch 2022-2026

Subject Name: Skill Development for Professionals- VII **Credit: 0.5**

Subject Code: SDP781 **Lecture Hours:48**

Module number	Topic	Sub- topics	Mapping with International/National/ State Level Exams	Lecture Hours	Corresponding Assignment
1	**Revision and Advanced Problems in Quantitative Aptitude:**	**Textbook:** Quantitative Aptitude for Competitive Examination **Author:** R.S Agarwal **Publishing House:** S. Chand 1. Simple Interest 2. Compound Interest 3. Speed, Time, Distance	*National Exams:* *1. UPSC Civil Services Exam (https://upsc.gov.in/sites/default/files/Notif-CSP-23-engl-010223.pdf), pg 25-26* *2. UPSC Combined Defence Services (https://upsc.gov.in/sites/default/files/Notif-CDS-I-Exam-2023-Engl-211222.pdf), pg 20-21* *3. Combined Graduate Level conducted by SSC (https://ssc.nic.in/SSCFileServer/PortalManagement/UploadedFiles/notice_CGLE_03042023.pdf) pg. 20-22* *4. Intelligence Bureau ACIO (https://www.pw.live/exams/wp-content/uploads/2023/11/IB-ACIO-Recruitment-2023-Notification-Emp-News.pdf) State Level Exams:* *1. Civil Services Executive Exam (WBCS) (https://wbpsc.gov.in/Download*	12	**Simple Interest:** 1. **The Impact of Time:** Compare the simple interest earned on a fixed principal at a constant rate over different time periods (e.g., 5 years vs. 10 years). 2. **Loan Repayment:** Calculate the total amount to be repaid on a loan with simple interest, including the principal and interest. 3. **Finding the Rate:** Given the principal, time, and interest earned, determine the simple interest rate. 4. **Simple Interest in Savings Accounts:** Analyze how simple interest affects the growth of savings in a bank account over time. **Simple Interest:** 1. **The Impact of Time:** Compare the simple interest earned on a fixed principal at a constant rate over different time periods (e.g., 5 years vs. 10 years). 5. **Loan Repayment:** Calculate the total amount to be repaid on a loan with simple interest, including the principal and interest. 6. **Finding the Rate:** Given the principal, time, and interest earned, determine the

			?param1=20230225142430_Syllabus.pdf&param2=advertisement), pg 1 ***2. Miscellaneous Services Recruitment Examination*** (https://adda247jobs-wp-assets-prod.adda247.com/jobs/wp-content/uploads/sites/7/2022/11/21142422/2707970_2019.pdf ***) pg 1***		simple interest rate. 7. **Simple Interest in Savings Accounts:** Analyze how simple interest affects the growth of savings in a bank account over time. **Speed, Time, Distance:** 1. **Fuel Efficiency:** Calculate how fuel consumption changes when a vehicle travels at different speeds over a fixed distance. 2. **Travel Planning:** Determine the arrival time of a journey considering the distance, average speed, and rest stops. 3. **Race Analysis:** Analyze the performance of athletes in a race, considering their speeds and distances covered at different intervals. 4. **Distance-Time Graphs:** Interpret distance-time graphs to determine the speed, acceleration, and rest periods of an object.
2	**Revision and Advanced Problems in Reasoning**	**Textbook:** Verbal and Non- Verbal reasoning **Author:** R.S Agarwal **Publishing House:** S. Chand 1. Miscellaneous Problems on Logical Reasoning [CAT level 4] 2. Analytical Puzzle	***3. Combined Graduate Level conducted by SSC (https://ssc.nic.in/SSCFileServer/PortalManagement/UploadedFiles/notice_CGLE_030420223.pdf) pg. 20-22*** ***4. Intelligence Bureau ACIO (https://www.pw.live/exams/wp-content/uploads/2023/11/IB-ACIO-Recruitment-2023-Notification-Emp-News.pdf) State Level Exams:*** ***1. Civil Services Executive Exam (WBCS)***	12	**Miscellaneous Problems on Logical Reasoning (CAT level 4):** 1. **Letter Series and Coding-Decoding:** Complex letter series with multiple interlinked patterns, coding-decoding problems with substitution ciphers and mathematical operations. 2. **Blood Relations and Family Tree:** Extensive family tree problems with multiple generations and complex relationships, including in-laws, step-relations, and adopted family members. 3. **Direction Sense and Distance:** Advanced direction sense problems with multiple turns, distances, and landmarks, incorporating concepts like

		Syllogism	*(https://wbpsc.gov.in/Download?param1=20230225142430_Syllabus.pdf&param2=advertisement), pg 1* **Miscellaneous Services Recruitment Examination** *(file:///C:/Users/UEMK/Downloads/2707970_2019.pdf) pg 1*		shadows and relative directions. 4. **Ranking and Order:** Complex ranking problems involving multiple criteria, groups, and variables, requiring deduction and elimination. 5. **Data Sufficiency:** Data sufficiency questions with multiple statements, requiring analysis of whether the information is sufficient to answer the question. **Analytical Puzzles:** • Order Based Puzzle • Floor Based Puzzle • Box Based Puzzle • Flat Based Puzzle • Matrix Puzzle • Distance based Puzzle • Schedule Puzzle • Classification Puzzle • Distribution Puzzle **Syllogisms:** • **Either-Or Case** • Neither -Nor Case • No and Some Not case Reverse Syllogism
3	**Revision and Advanced Questions in Verbal English**	**Textbook:** Objective General English **Author:** R.S Agarwal **Publishing house:** S. Chand 1. Miscellaneous 2. Spotting Errors 3. Fillers. Advanced	*National Exams:* *1. UPSC Civil Services Exam (https://upsc.gov.in/sites/default/files/Notif-CSP-23-engl-010223.pdf), pg 25-26* *2. UPSC Combined Defence Services (https://upsc.gov.in/sites/default/files/Notif-CDS-I-Exam-2023-Engl-211222.pdf), pg 20-21*	12	**1. Miscellaneous:** • Sentence Transformation • Error Correction (General • Idiom and Phrase Usage **2. Spotting Errors:** • Noun Error • Verb Tense Errors • Preposition Errors

		Application of 5. Vocabulary 4. Reading Comprehension Curriculum Vitae writing/ Argument Writing	***3. Combined Graduate Level conducted by SSC (https://ssc.nic.in/SSCFileServer/PortalManagement/UploadedFiles/notice_CGLE_03042023.pdf) pg. 20-22*** ***4. Intelligence Bureau ACIO (https://www.pw.live/exams/wp-content/uploads/2023/11/IB-ACIO-Recruitment-2023-Notification-Emp-News.pdf)*** ***State Level Exams:*** ***1. Civil Services Executive Exam (WBCS) (https://wbpsc.gov.in/Download?param1=20230225142430_Syllabus.pdf&param2=advertisement, pg 1*** ***2.*** **Miscellaneous Services Recruitment Examination** (https://adda247jobs-wp- assets-prod.adda247.com/jobs/wp-content/uploads/sites/7/2022/11/21142422/2707970_2019.pdf***) pg 1***		• Article Errors • Pronoun Errors • Adjective Errors • Adverb Errors **3. Fillers:** • **Single Word Fillers:** Provide sentences with blanks and multiple-choice options for the correct word. • **Double Blank Fillers:** Give sentences with two blanks and options for each, requiring students to choose the best combination. • **Phrase Fillers:** Include sentences with blanks that need to be filled with appropriate phrases or idioms. **4. Advanced Application of Vocabulary:** • **Synonym/Antonym Discrimination:** Give words and have students identify synonyms and antonyms from a list of options, emphasizing subtle differences in meaning. • **One Word Substitution** **5. Reading Comprehension:** **6. Curriculum Vitae (CV) Writing/Argument Writing:** • **CV Writing:** Provide guidelines and examples for writing an effective CV, emphasizing proper formatting, concise language, and highlighting relevant skills and experiences. **Argument Writing:** Give a controversial topic or issue and have students write an argumentative essay, presenting evidence to support their stance

					and refuting opposing viewpoints.
4	**Data Interpretation**	**Textbook:** Quantitative Aptitude for Competitive Examination **Author:** R.S Agarwal **Publishing House:** S. Chand 1. Various Charts 2. Diagrams Tables	***National Exams:*** ***1. UPSC Civil Services Exam (https://upsc.gov.in/sites/default/files/Notif-CSP-23-engl-010223.pdf), pg 25-26*** ***2. UPSC Combined Defence Services (https://upsc.gov.in/sites/default/files/Notif-CDS-I-Exam-2023-Engl-211222.pdf), pg 20-21*** ***3. Combined Graduate Level conducted by SSC (https://ssc.nic.in/SSCFileServer/PortalManagement/UploadedFiles/notice_CGLE_030420232023.pdf) pg. 20-22*** ***4. Intelligence Bureau ACIO (https://www.pw.live/exams/wp-content/uploads/2023/11/IB-ACIO-Recruitment-2023-Notification-Emp-News.pdf)*** ***5. RBI Grade B (https://rbidocs.rbi.org.in/rdocs/Content/PDFs/DADVTGRB09052023FA65E4FB1C2CF473396B4FD7E5F69CDDE.PDF), pg 22- 23*** ***State Level Exams:*** ***6. Civil Services Executive Exam (WBCS) (https://wbpsc.gov.in/Download?param1=20230225142430***	12	Application of Data Analysis in the forms of following charts: 1. Tabular 2. Bar 3. Pie **3.** Line Graph

			_Syllabus.pdf&param2=advertisement), pg 1 **MiscellaneousServices Recruitment Examination** (https://adda247jobs-wp-assets- prod.adda247.com/jobs/wp-content/uploads/sites/7/2022/11/21142422/2707970_2019.pdf) ***pg 1***		

MANDATORY ADDITIONAL REQUIREMENT (MAR)

- Tech Fest/Fest/Teachers' Day/Fresher's Welcome
- Rural Reporting
- Tree Plantation
- Participation in Relief Camps (Collection of funds/materials for the Relief Camp)
- Animal Welfare Camp
- Participation in Debate/Group Discussion/Tech Quiz/Quiz
- Publication of Wall Magazine in institutional level (magazine/article/internet)
- Publication in Newspaper, Magazine and Blogs
- Research Publication
- Innovative Projects (other than course curriculum)
- Blood donation
- Participation in Sports/Games (College level /University level / District level / State level National/International Level)
- Cultural Programme (Dance, Drama, Elocution, Music etc.)
- Member of Professional Society /Student Chapter
- Relevant Industry Visit & Report
- Activities in different Clubs (Photography / dance/drama etc. Club)
- Participation in Yoga Camp
- Adventure Sports with Certification
- Training to under-privileged/differently able
- Community Service & Allied Activities
- Self-Entrepreneurship Programme (Organize Entrepreneurship Workshop /To take part in Entrepreneurship Workshop /Video Film-Making on Entrepreneurship /Submit Business Plan on any / To work for start-up/as entrepreneur)

Massive open online course MOOCs

https://docs.google.com/spreadsheets/d/e/2PACX-1vQxHuRpCPTN16ho3JJzQQED9JyO06qKTDdipAI8ui2MCSRY3FtQCuqFBozkYoV8vjNOZbhUjA259-SN/pubhtml