DR. BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY

CIRCULAR NO.SU/Engg./B.E./03/2019

It is hereby informed to all concerned that, the syllabi prepared by the Board of Studies & recommended by the Dean, Faulty of Science & Technology the **has accepted the following syllabi in accordance with Choice Based Credits & Grading System for all Branches of B.E. Final Year** in his emergency powers under section 12(7) of the Maharashtra Public Universities Act, 2016 on behalf of the Academic Council and Management Council as enclosed herewith:-

Sr.No.	Syllabi as per CBC & GS
[1]	**Final Year B.E.[Civil Engineering],**
[2]	**Final Year B.E [Mechanical Engineering],**
[3]	**Final Year B.E [EE/EEE/Electrical, Electronics & Power,],**
[4]	**Final Year B.E [Chemical Engineering],**
[5]	**Final Year B.E [Instrumentation Engineering],**
[6]	**Final Year B.E [E&TC/E&C/IE/ECT],**
[7]	**Final Year B.E [CSE/IT].**

This is effective from the Academic Year 2019-2020 and onwards.

All concerned are requested to note the contents of this circular and bring the notice to the students, teachers and staff for their information and necessary action.

University Campus,
Aurangabad-431 004.
REF.NO.SU/2019/387 - 819
Date:- 24-07-2019.

*****

Deputy Registrar,
Syllabus Section

Copy forwarded with compliments to :-

1] The Principals, affiliated concerned Colleges, Dr. Babasaheb Ambedkar Marathwada University.

2] The Director, University Network & Information Centre, UNIC, with **a request to upload this Circular on University Website.**

Copy to :-

1] The Director, Board of Examinations & Evaluation,
2] The Section Officer, [Engineering Unit] Examination Branch,
3] The Section officer, [Eligibility Unit],
4] The Programmer [Computer Unit-1] Examinations,
5] The Programmer [Computer Unit-2] Examinations,
6] The In-charge, [E-Suvidha Kendra],
7] The Public Relation Officer,
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International Centre of Excellence in Engg. & MGMT. ★ Aurangabad ★

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Aurangabad

DR. BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY, AURANGABAD.

Curriculum of

B.E.

Mechanical Engineering

Under Choice Based Credit & Grading System

UNDER THE FACULTY OF SCIENCE & TECHNOLOGY.

[Effective from 2019-20 & onwards]

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Dr. Babasaheb Ambedkar Marathwada University, Aurangabad

FACULTY OF SCIENCE AND TECHNOLOGY

Syllabus Structure (CBCS) For A. Y. 2019-20

Fourth (Final) Year of Bachelor of Engineering (Mechanical Engineering)

SEMESTER: VII

Subject Code	Semester : V	Contact Hrs / Week			Examination Scheme					Credit Structure			Duration of Theory Exam
	Subject	L	P	Total	CT	TH	TW	P	Total	T	P	Total	
MED401	I. C. Engines And Gas Turbines	4		4	20	80			100	4		4	3 Hours
MED402	Automatic Control System	4		4	20	80			100	4		4	3 Hours
MED403	Metrology and Quality Control	4		4	20	80			100	4		4	3 Hours
MED404	Energy Conservation and Management	4		4	20	80			100	4		4	3 Hours
	Elective-II**	4		4	20	80			100	4		4	3 Hours
MED421	Lab-I I.C. Engines And Gas Turbines		2	2			25	25	50		1	1	
MED422	Lab-II Automatic Control System		2	2			25		25		1	1	
MED423	Lab-III Metrology and Quality Control		2	2			25	25	50		1	1	
MED424	Lab-IV : Energy conservation and Management		2	2				25	25		1	1	
	Seminar		2				50		50		2	2	
	Project-I		2					50	50		2	2	
	Total	**20**	**12**	**32**	**100**	**450**	**125**	**125**	**750**	**20**	**8**	**28**	

Elective – II:

Course code	Subject Name
MED405	Mechatronics
MED406	Power Plant Engineering
MED407	Production Planning and Control
MED408	Advanced Materials and Manufacturing
MED409	Advanced CAD/CAM
	Open Elective

SEMESTER : VIII

Subject Code	Semester : VI	Contact Hrs / Week			Examination Scheme					Credit Structure			Duration of Theory Exam
	Subject	L	P	Total	CT	TH	TW	P	Total	T	P	Total	
MED451	Automobile Engineering	4		4	20	80			100	4		4	3 Hours
MED452	Project Management and Operation Research	4		4	20	80			100	4		4	3 Hours
MED453	Refrigeration and Air Conditioning	4		4	20	80			100	4		4	4 Hours
	Elective-III**	4		4	20	80			100	4		4	3 Hours
MED471	Lab-VI Automobile Engineering		2	2			25	25	50		1	1	
MED472	Lab-VII Project Management and Operation Research		2	2			25	25	50		1	1	
MED473	Lab-VIII Refrigeration and Air Conditioning		2	2			25	25	50		1	1	
MED474	Lab-Elective		2	2			50		50		1	1	
	Project-II***		4	4			50	100	150		4	4	
Total		16	12	28	80	320	175	175	750	16	8	24	

Elective-III:

MED454	Finite Element Analysis
MED455	Aerospace Engineering
MED456	Industrial Engineering
MED457	Computational Fluid Dynamics
MED458	Tribology
	Open Elective

L: Lecture Hours per Week T: Tutorial Hours per Week P: Practical Hours per Week CT: Class Test

TH: University Theory Exam. **TW:** Term Work PR: Practical/ Oral Exam.

Note: **Student can opt for open elective. ***Projects can be interdisciplinary

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MED401-INTERNAL COMBUSTION (I. C.) ENGINES AND GAS TURBINES

Teaching Scheme

Lectures: 4 Hrs/week

Credit: 4

Examination Scheme

Theory Exam: 80 Marks (3Hrs.)

Class Test: 20 Marks (1Hrs.)

Objectives:

- Students are expected to understand &analyze the fundamentals and working of InternalCombustion Engines to meet the modern requirements.
- Students are expected to understand & analyze the fundamentals and working of gas turbines

Course Contents:

Unit-1: **(07Hrs)**

Introduction: Basic Engine components and Nomenclature, Classification of Engines, The working principle of I.C. Engines, Comparison of 2-Stroke and 4-Stroke Engines; CI, and SI Engines, Air standard cycles, Fuel air cycle and actual cycle. Valve timing Diagram.

Fuels, Carburetors & Fuel Injection: Conventional fuels for IC engines, requirement, Qualities of engine fuels, fuel additive and alternative fuels. Air Fuel Mixture Requirements, Carburetors, Requirement of Injection Systems, Classification of Injection Systems, Fuel Feed pump, Injection Pumps, Working principles of Governors, Types of Nozzles.

Unit-2: **(07Hrs)**

Combustion SI Engine: Stages of combustion, factors influencing various stages, Normal and abnormal combustion, Detonation, Factors responsible for detonation. Effect of detonation. Octane rating of fuel, Requirement of combustion chambers for SI engines, important types, relative advantages and disadvantages and application.

Unit-3: **(06Hrs)**

Combustion in CI. Engines: Stages of combustion in CI Engines, Delay period, factor affecting delay period, diesel knock, cetane rating, Requirements of combustion chamber for CI Engines. Methods of generating turbulence in combustion chamber. Types of combustion chamber for CI Engines.

Unit-4: **(07Hrs)**

Performance Parameters for IC Engines: Engine Power, Engine Efficiencies, Performance Characteristics, Variables Effecting Performance Characteristics, Methods of Improving Engine Performance, Heat Balance. Supercharging: Basic principles, objectives, arrangements for super charging, advantages and limitations of super charging.

Unit-5: **(05Hrs)**

Emission from IC Engines: Review, their effect on human health, cause of formation and approaches to control pollutants. Study of BIS, EURO emission norms, IC Engines Recent trends: Microprocessor based engines, multi-point fuel injection (MPFI) engines, common rail direct injections (CRDI) engines, variable valve timing engines and homogeneous charge compression ignition (HCCI) engines. Stratified engines, Wankel engine and Stirling engine.

Unit-6: **(08Hrs)**

Gas Turbine: Introduction to Gas Turbines, Development, Classification and Application of Gas Turbines, Ideal and Actual Cycles; Analysis of constant pressure closed cycle and open cycle gas turbine, Advantages and disadvantages of closed cycle over open cycle gas turbine, Methods for improvement of thermal efficiency of gas turbine, Effect of Inter cooling, Reheating and Regeneration. Advantages and disadvantages of gas turbine over I.C. Engines

Section – A Unit 1, 2 and 3
Section – B Unit 4, 5 and 6

References:

1. Internal combustion Engines Fundaments- John B. Heywood, McGraw Hill.
2. Internal combustion Engines - M.L. Mathur & Sharma Dhanpatrai & Sons.
3. Internal combustion Engines/ Gas Turbines – V. Ganeshan, McGraw Hill.
4. Internal combustion Engines- Collin R. Ferguson & Allan T. Kirkpatric.
5. An introduction to combustion- Stephen R. Turns, McGraw Hill.
6. Internal combustion engines & air pollution- Edward Obert, Intex Educational Pub.
7. Gas Turbine Theory/ HIH Saravanamuttoo, Cohen, Rogers/ Pearson
8. Internal combustion Engines- V. M. Domkundwar, Dhanpat Rai & Co.

Pattern of Question Paper:

The units in the syllabus are divided in two equal sections. Question paper consists of two sections A and B. Section A includes first three units (1, 2, and 3) and Section B includes remaining three units (4, 5 and 6). Question paper should cover the entire syllabus.

For 80 marks Paper:

1. Five questions in each Section.
2. Question no. 1 and 6 are compulsory for 10 marks each which contains short answer questions of 02 marks each.
3. From remaining four questions, attempt any two questions from each section.

MED402- AUTOMATIC CONTROL SYSTEM

Teaching Scheme

Lectures: 4 Hrs/week

Credit: 4

Examination Scheme

Theory Exam: 80 Marks (3Hrs.)

Class Test: 20 Marks (1Hrs.)

Objectives

- Understand basic control concepts and control actions.
- Understand simple mathematical modeling and the concept of block diagram and signal flow graph.
- Study of system in time & frequency domain and understand concept of stability.

Course Contents: **(08 Hrs)**

Unit1:

Introduction: Need of control system, Manual Vs. Automatic Control System, Advantages of Automatic Control System, Open Loop and Closed Loop Control System and their comparison, Concept of Feedback, Requirements of Ideal Control System, Generalized Control System and Definition of Transfer Function.

Representation Of Control System Components: Study of various types of control system components and their mathematical representation used in systems like Mechanical system, Electrical System, Thermal System, Fluid System, Grounded chair representation, Force-Voltage and Force-Current Analogy

(06 Hrs)

Unit 2:

Block Diagram and Signal Flow Graph(SFG): Transfer function definition, Block representation of System Elements, Block Diagram Reduction, Conversion of Block Diagram to Signal Flow Graph(SFG) and vice versa, Mason's Gain Formula, Comparison of Block Diagram and Signal Flow Graph(SFG), Finding Transfer Function of Control System by both methods.

(06 Hrs)

Unit 3:

Control Action and Controllers: Basic types of control action like ON/OFF, Proportional, Integral, Derivative type and their combinations (P, I, PI, PD and PID), Pneumatic and Hydraulic Controllers, Comparison of Pneumatic and Hydraulic Control System.

Electrical Systems: Detail study of AC and DC Servo motors, Stepper motors, Servomechanism, Position Control System

(08 Hrs)

Unit 4:

Transient and Steady State Response Analysis: Introduction, Various types of standard input signals, First order response to Step, Ramp and Impulse Input, Response of second order system to step input,

System specifications, Concept of time constant and its importance in speed response, Effect of Damping ratio on response of Second Order System.

(08 Hrs)

Unit 5:

Frequency Response Analysis: Stability analysis, System Stability and Routh's Stability Criteria, Relative Stability Concepts, Nyquist stability criterion, Polar plots, Phase and Gain Margin, Bode Plot attenuation diagram, Stability analysis using Bode plots, Simplified Bode plot

(04 Hrs)

Unit 6:

Root Locus Plots: Definition of Root loci, General Rules for constructing Root Locus, Analysis using Root Locus Plots, Use of MATLAB software in control system.

Section – A Unit 1, 2 and 3
Section – B Unit 4, 5 and 6

References:

1. Modern Control Engineering- Katsuhiko Ogatta, Prentice Hall Of India Pvt. Ltd.
2. Automatic Control Systems- Benjamin C Kuo, Farid Golnarghi, Wiley India
3. Control Systems Engineering- Norman S Nise, Wiley India
4. Control Systems-Principles and Design- M.Gopal, McGraw Hill
5. Feedback Control System- Dr.S.D Bhide, S.Satyanarayan, N.A Jalgaonkar, Technova Publications
6. Control System Engineering- I.J Nagrath, M.Gopal, New Age International Publishers
7. Feedback Control Systems- R.A Barapate, Tech Max Publications Pune

Pattern of Question Paper:

The units in the syllabus are divided in two equal sections. Question paper consists of two sections A and B. Section A includes first three units (1, 2, and 3) and Section B includes remaining three units (4, 5 and 6). Question paper should cover the entire syllabus.

For 80 marks Paper:

1. Five questions in each Section.
2. Question no. 1 and 6 are compulsory for 10 marks each which contains short answer questions of 02 marks each.
3. From remaining four questions, attempt any two questions from each section.

MED403-METROLOGY & QUALITY CONTROL

Teaching Scheme

Lectures: 4 Hrs/week

Credit: 4

Examination Scheme

Theory Exam: 80 Marks (3Hrs.)

Class Test: 20 Marks (1Hrs.)

Objectives:-

- Understand the principles, construction, use, techniques of handling and maintenance of various measuring instruments.
- Plot and use of quality control charts and Suggest measures to improve the quality of product and reduce cost.
- Students are expected to understand the fundamentals of quality & to apply different statistical process control tools for managerial decisions.

Course Contents:

Unit1: **(10Hrs)**

a) Introduction to Metrology: definition of Metrology, legal metrology, Types and Sources of error, factor affecting on accuracy, Need of Inspection,

b) Measurement Standard, Line end, wavelength, Traceability of Standards., Alignment, Temperature, Plastic deformation, Slip gauges and gauge block, Linear and Angular Measurement (Sine bar, Sine center, Autocollimator, Angle Décor and Dividing head), Calibration .

c) Comparator – definition, requirement of good comparators, Working principle of comparators, Mechanical, Pneumatic, Optical, Electronic (Inductive), Electrical (LVDT)

Unit2: **(06 Hrs)**

a) Interferometer- Principle, NPL Interferometer, Flatness measuring of slip gauges, Parallelism, Laser Interferometer Surface Finish Measurement – Surface Texture, Measuring Surface Finish by Stylus probe, Tomlinson and Taly – Surf, Analysis of Surface Traces

b) Methods Design of Gauges - Types of Gauges, Limits, Fits, Tolerance, and Terminology for limits and Fits. Selective assembly, interchangeability, Indian Standard (IS 919-1963) Taylor's Principle.

Unit3: Metrology of Screw thread **(04Hrs)**

Gear Metrology – Gear error, Gear measurement, Gear Tooth Vernier, Profile Projector, Tool marker's microscope. Advancements in Metrology – Co-ordinate Measuring Machine(CMM), Universal Measuring Machine(UMM) , Laser in Metrology.

Unit 4:Introduction to Quality and Quality Tools **(06Hrs)**

Definition, Meaning of quality of produce and services, Quality of Design, Quality of Conformance, Quality of Performance, Cost of Quality and Value of Quality, , Seven Quality Tools – check sheet, Flow chart, Pareto analysis, cause and effect diagram, scatter diagram, Brain storming, Quality circles.

(06Hrs)

Unit 5: Total Quality Management

Quality Function Deployment, 5S, Kaizan, Kanban, Just In Time, Poka yoke, TPM, FMECA, FTA, Zero defects.

(08Hrs)

Unit 6:Statistical Quality Control

a) Statistical Quality Control – Basic statistical concept, Meaning and importance of SQC, Frequency diagram, Concept of Variance analysis, Control chart for variable & attribute, Process Capability.
b) Acceptance Sampling: Concept, comparison with 100% inspection, OC curve and its characteristics, sampling methods.
c) Introduction to ISO 9000: Definition and aims of standardizations, Techniques of standardization, Codification system, Varity control and Value Engineering.

Section – A Unit 1, 2 and 3
Section – B Unit 4, 5 and 6

References:

1. Jain R.K. – Engineering Metrology, Khanna Publication
2. Hume K.J. – Engineering Metrology – Mcdonald Publications
3. A.W.Judge – Engineering Precision Measurements, Chapman and Hall
4. Narayana K.L. – Engineering Metrology
5. Galyer J.F & Shotbolt C.R – Metrology for Engineers
6. I.C.Gupta – Engineering Metrology, Dhanpat rai Publications
7. Kulkarni V.A & Bewoor A.K – Metrology & Measurements, Tata McGraw hill Co. Ltd.
8. Statistical Quality Control – M.S.Mahajan. Dhanpat rai Publications
9. Fundamental of Quality Control and Improvement – Amitava Mitra. – Wiley Publication.
10. Quality Control – V.A.Kulkarni and A.K.Bewoor.-Wiley India Publication.
11. Statistical Quality Control – E.L.Grant –McGraw Hill.
12. Quality Planning and Analysis – J.M.Juran – Tata McGraw Hill

Pattern of Question Paper:

The units in the syllabus are divided in two equal sections. Question paper consists of two sections A and B. Section A includes first three units (1, 2, and 3) and Section B includes remaining three units (4, 5 and 6). Question paper should cover the entire syllabus.

For 80 marks Paper:

1. Five questions in each Section.

2. Question no. 1 and 6 are compulsory for 10 marks each which contains short answer questions of 02 marks each.
3. From remaining four questions, attempt any two questions from each section.

MED404-ENERGY CONSERVATION AND MANAGEMENT

Teaching Scheme

Lectures: 4 Hrs/week

Credit: 4

Examination Scheme

Theory Exam: 80 Marks (3Hrs.)

Class Test: 20 Marks (1Hrs.)

Objective: Students are expected to learn the importance and the need for conserving the Energy and apply the knowledge gain through methodologies and the management techniques in the energy conservation.

Course Content:

Unit-1: Energy Scenario and Renewable Systems **(08 Hrs)**

Commercial and Non-Commercial Energy, Primary Energy Resources, Energy Pricing, Importance of Energy Conservation, Energy Security, Energy Conservation Act and Star Rating by BEE,Road map of Jawaharlal Nehru National Solar Mission,Energy Efficiency in Buildings: Earth air heat exchangers, Skylight, Photovoltaic systems, Kyoto Protocol, Clean Development Mechanism (CDM).

Unit-2: Mechanical System **(08 Hrs)**

Thermal Energy Systems and Energy conservation in Boilers, Steam distribution system, compressed air systems, refrigeration and air-conditioning system, pumps and fans.Solar hot water systems, Basics of Biofuels, International recent advances in Biodiesel, its resources for production, case studies of biofuels production etc.

Unit-3: Co-generation **(04 Hrs)**

Case study of Cogeneration in Sugar Factories, various options of cogeneration in Industries, selection criteria, control strategy.

Unit-4: Electrical system **(8 Hrs)**

E-vehicle for emission control, E-vehicle power storage options, merits and demerits of E-vehicle, Requirement of Charging station for E-vehicle, Power Generation and Demand Side Management (DSM), Power factor improvement, Load Scheduling, Energy-efficient electric motors, variable speed drive, Strategy for daylight control and artificial energy efficient illumination.

Unit-5: Energy Audit **(08 Hrs)**

Definition, Need of Energy audit, Types of energy audit, Energy audit steps/methodologies, Instruments for Energy audit, Case study of Energy Audit at household and in Sugar/Glass/Paper Industries etc.

Unit-6: Financial Management: **(08 Hrs)**

Energy flow Sankey Diagrams, Energy conservation options for household and industry, Investment on energy efficient appliances and renewable energy systemand its financial analysis using Simple payback period, Return on investment, Net present value, Internal rate of return, Life cycle costs etc.

Section – A Unit 1, 2 and 3
Section – B Unit 4, 5 and 6

References:

1. S.K. Shukla and J. Tirkey, Text Book on Energy Conservation and Management, Narosa Publication.
2. Yogi Goswami and F. Kreith, Reference Book on Energy Conversion, CRC Press.
3. Amlan Chakrabarti, Text Book on Energy Engineering and Management, PHI Learning Press.
4. G. Kaushik, S. Patil, S. Chaturvedi and A. Chel, Reference Book on Biofuels: Advances and Perspectives, Studium Press, 2018.
5. D. Mukherjee, S. Chakrabarti, Text Book on Fundamentals of Renewable Energy Systems, New Age Publication.
6. S.P. Sukhatme and J.K.Nayak, Text Book on Solar Energy: Principles of Thermal Collection and Storage, The McGraw Hill Publication.
7. A. Chel, Reference book on Thermal Model: Adobe house, Earth Air heat exchanger, Skylight & PV, Lambert Academic Publishing.
8. Y.P.Abbi, Handbook on Energy Audit: Thermal Plants, Combined Cycle and Cogeneration Plants, The Energy and Resources Institute, TERI Press.
9. I. Dincer, Reference Book on Comprehensive Energy Systems, Elsevier Publication.

Pattern of Question Paper:

The units in the syllabus are divided in two equal sections. Question paper consists of two sections A and B. Section A includes first three units (1, 2, and 3) and Section B includes remaining three units (4, 5 and 6). Question paper should cover the entire syllabus.

For 80 marks Paper:

1. Five questions in each Section.
2. Question no. 1 and 6 are compulsory for 10 marks each which contains short answer questions of 02 marks each.

3. From remaining four questions, attempt any two questions from each section.

MED405- ELECTIVE – II: MECHATRONICS

Teaching Scheme

Lectures: 4 Hrs/week

Credit: 4

Examination Scheme

Theory Exam: 80 Marks (3Hrs.)

Class Test: 20 Marks (1Hrs.)

Objectives:

- To provide a clear view on key elements of mechatronics system, representation into block diagram To accustom with various sensors, data acquisition system
- To impart knowledge about microprocessor, microcontrollers used in mechatronics
- To familiarize with PLC programming

Course Content:

Unit 1: **(07 Hrs)**

Introduction of Mechatronics. Sensors - working characteristics and mathematical model of Thermal sensors, Pressure sensors, Strain sensors, load cell, Motion sensor, Accelerometer, Optical sensors, Photo diode, Photo Emissive, Force sensors, Torque sensor

Unit 2: **(07 Hrs)**

Hydraulic, Pneumatic & Electrical systems - Elements, Construction, Operation, Standard Symbols and Industrial Applications. Hydraulic and Pneumatic Circuits.

Unit 3: **(06 Hrs)**

Introduction and significance of data acquisition system, types of DAS, Signal conditioning system, Industrial Applications.

Unit 4: **(06 Hrs)**

Digital Logic, Logic Gates, Boolean algebra. Principles of basic electronics Microprocessors / microcontroller, Industrial Applications, Hardware in mechatronics systems.

Unit 5: **(07 Hrs)**

Interfacing, DA and AD converters, software and hardware principles and tools to build mechatronics systems. Programming Logic Controllers (PLC): basic structure, selection of PLCs, Ladder Programming in Industrial Applications

Unit 6: **(07Hrs)**

Advanced applications in mechatronics: mechatronics control in automated manufacturing, CIM, Robot, Artificial Intelligence in mechatronics, fuzzy logic applications in mechatronics, micro sensor.

Section – A Unit 1, 2 and 3
Section – B Unit 4, 5 and 6

Reference Books

1. Ernest O. Doeblin, "Measurement Systems Application and Design", McGraw Hill International Publication

2. Bolton, "Mechatronics" ,Pearson, Singapore

3. Mahalik , "Principles, concepts and applications Mechatronics" ,TMH

4. Ramesh Gaonkar, "Introduction to 8085-PENRAM",International Publishing.

5. Muzumdar, "Pneumatics" –Tata McGraw-Hill Education.

6. Pipenger, "Hydraulic valves and controls" ,M. Dekker.

7. K. Ayala, "8051 microcontroller Architecture, programming & Application" - Penram International Publishing

8. Steward, "Hydraulics and Pneumatics for production",Audal Series.

9. "Fundamentals of Pneumatics" , Festo series.

10. Vickers's manual on "hydraulics".

11. Curtis D. Johnson,"Process Control instrumentation Technology" –PHI Publication

Pattern of Question Paper:

The units in the syllabus are divided in two equal sections. Question paper consists of two sections A and B. Section A includes first three units (1, 2, and 3) and Section B includes remaining three units (4, 5 and 6). Question paper should cover the entire syllabus.

For 80 marks Paper:

1. Five questions in each Section.
2. Question no. 1 and 6 are compulsory for 10 marks each which contains short answer questions of 02 marks each.
3. From remaining four questions, attempt any two questions from each section.

MED-406 - ELECTIVE-II- POWER PLANT ENGINEERING

Teaching Scheme

Lectures: 4 Hrs/week

Credit: 4

Examination Scheme

Theory Exam: 80 Marks (3Hrs.)

Class Test: 20 Marks (1Hrs.)

Objective:

The objectives of the course is to enable the student:

- To describe the sources of energy and types of power plant.
- To introduce students to different aspects of power plant engineering.
- To familiarize student to the working of conventional power plants based on different fuels.

Course Content:

Unit-1: **(06Hrs)**

Introduction: Generation of Electricity and sources of energy, future trends in power industry,Load estimation, load duration curve, load factor, capacity factor, use factor, diversity factor, anddemand factor, effect of variable load on power plant, selection of the number and size of units.(Descriptive and Numerical treatment)

Unit-2: **(08Hrs)**

Thermal Power Plant : General layout of modern Thermal power plant ,Working of Thermal power plant, Site Selection for Thermal power plant, thermodynamic cycles, Coal handling, storage, Preparation & Feeding, combustion and combustion equipments, Ash handling and dust collection, draught system.(Descriptive only)

Unit-03: **(06Hrs)**

Diesel Engine Power Plant : Layout of Diesel engine Power Plant, Type of Engines used for Diesel power plants, cooling & lubrication system for the diesel engines, filters, supercharging of Diesel engines , performance of diesel plant, advantages and limitations of diesel plant over thermal plant , Present Trends in Diesel research.(Descriptive only)

Unit-4: **(04Hrs)**

Economic Analysis of Power Plants: Cost of energy production, selection of plant and generating equipment, performance and operating characteristics of power plants, Tariffs for electrical energy. Environmental aspects of power generation.(Descriptive and Numerical treatment)

(08Hrs)

Unit-5:

Hydroelectric Power Plant: Hydrograph, flow duration & mass curves. General arrangement of an hydroelectric project and its operation , site selection, Storage and pond age, classification of hydro stations, selection of prime movers, operation of different components of hydro station reservoirs .Dams, spill ways, canals, penstock, water hammering effects, surge tank, advantages of hydro station. (Descriptive only)

(08Hrs)

Unit-6:

Nuclear Power Plant: Principle of release of nuclear energy fusion & fission reaction, nuclear fuels used in reactors ,multiplication and thermal utilization factors, elements of nuclear reactor ,moderators ,control rod ,fuel rods ,coolants ,brief description of reactor PWR , BWR ,sodium graphite reactor, fast breeder reactor ,Homogenous reactor and gas cooled reactors, radiation hazard , shielding, radioactive waste disposal. Safety Rules: Personal Monitoring, Radiation Protection (Radiation Workers, Non-Radiation Workers, Public at large), Radiation Dose (Early effect, Late effect hereditary effect). (Descriptive only)

Section – A Unit 1, 2 and 3
Section – B Unit 4, 5 and 6

References:

1. A Course in Power Plant engineering by Arora and Domkundwar.
2. Power station Engineering Economics by Skrotizke and Vopat.
3. Power Plant engineering by P K Nag.
4. Modern Power Plant Engineering, Joel Weisman & Ray Eckart Prentice hall,International Inc.
5. Power Plant Technology, by M.M.El-Wakil, McGraw Hill Education (India) Pvt Ltd.
6. Power Station Engineering and Economy Barnhardt G. Askratzki & William A VopaTMH Publications co Ltd.
7. Power Plant Engineering by Fredrick T Mores Affiliated East West press private Ltd.
8. Power Plant Engineering by Black & Veatch.

Pattern of Question Paper:

The units in the syllabus are divided in two equal sections. Question paper consists of two sections A and B. Section A includes first three units (1, 2, and 3) and Section B includes remaining three units (4, 5 and 6). Question paper should cover the entire syllabus.

For 80 marks Paper:

1. Five questions in each Section.
2. Question no. 1 and 6 are compulsory for 10 marks each which contains short answer questions of 02 marks each.
3. From remaining four questions, attempt any two questions from each section.

MED 407- Elective-II- PRODUCTION PLANNING AND CONTROL

Teaching Scheme

Lectures: 4 Hrs/week

Credit: 4

Examination Scheme

Theory Exam: 80 Marks (3Hrs.)

Class Test: 20 Marks (1Hrs.)

Objectives:

- To understand the various components and functions of production planning and control
- To know the recent trends like manufacturing requirement Planning (MRP) and Enterprise Resource planning (ERP).
- To know the importance of selection of material, machines, methods and manpower.

Course Contents:

Unit – 1: **(04Hrs)**

Introduction: Definition – Objectives of production Planning and Control – Functions of production planning and control –Types of production – Organization of production planning and control department – Internal organization of department – Information required for Production Planning.

Unit – 2: **(08Hrs)**

Forecasting – Importance of forecasting – Types of forecasting, their uses – General principles of forecasting – Forecasting techniques – qualitative methods and quantitive methods.

Unit – 3: **(08Hrs)**

Inventory management – Functions of inventories – relevant inventory costs – ABC analysis – VED analysis – EOQ model – Inventory control systems – P–Systems and Q-Systems – Introduction to MRP & ERP, LOB (Line of Balance).

Unit – 4: **(04Hrs)**

Routing – Definition – Routing procedure –Route sheets – Bill of material – Factors affecting routing procedure. Schedule –definition – Difference with loading.

Unit – 5: **(08Hrs)**

Scheduling Policies – Techniques, Standard scheduling methods, Line Balancing, Aggregate planning, Chase planning, Expediting, controlling aspects. Dispatching – Activities of dispatcher – Dispatching procedure – followup – definition – Reason for existence of functions – types of followup - applications of computer in production planning and control.

Unit – 6: **(08Hrs)**

Selection of materials, methods, machines and manpower: Factors / restrictions to be considered while selecting materilas, Process / Method selection, Machine selection: factors to be cosidered while selecting a machine. Recrutment and selection of manpower: sources of recruitment, scientific selection, transfer, promotion, control of absenteeism, tardiness and labour turnover.

Section – A Unit 1, 2 and 3
Section – B Unit 4, 5 and 6

References:

1. Modern Production/ operation managements / Baffa & Rakesh Sarin/Wiley & Sons.
2. Elements of Production Planning and Control / Samuel Eilon/ Collier Macmillan Ltd.
3. Manufacturing Planning and control/ Partik Jonsson & Stig-Arne Mattsson/ TATA Mc Graw – HILL Edition.
4. Inventory Control Theory and Practice / Martin K. Starr and David W. Miller/ Prentice-Hall.
5. Production Planning & Control / M. Mahajan / Dhanpat Rai & Co.
6. Production Control A Quantitative Approach / John E. Biegel/ Prentice-Hall.
7. Production Control / Franklin G. Moore, Ronald Jablonski/ McGraw-Hill.

Pattern of Question Paper:

The units in the syllabus are divided in two equal sections. Question paper consists of two sections A and B. Section A includes first three units (1, 2, and 3) and Section B includes remaining three units (4, 5 and 6). Question paper should cover the entire syllabus.

For 80 marks Paper:

1. Five questions in each Section.
2. Question no. 1 and 6 are compulsory for 10 marks each which contains short answer questions of 02 marks each.

3. From remaining four questions, attempt any two questions from each section.

MED 408 - ELECTIVE-II- ADVANCED MATERIALS AND MANUFACTURING

Teaching Scheme

Lectures: 4 Hrs/week

Credit: 4

Examination Scheme

Theory Exam: 80 Marks (3Hrs.)

Class Test: 20 Marks (1Hrs.)

Objective:

- Students are expected to understand advance engineering materials
- Students are expected to understand advances in manufacturing processes.

Course Content:

Unit-1: **(08Hrs)**

Composites: Classifications, properties, application of composites, polymer matrix materials, metal matrix materials, ceramic matrix materials, Nature made composites, carbon materials, glass materials, fiber reinforcements, types of fibers, whiskers, laminar composite, filled composites, particulate reinforced composites, design of composites materials, hybrid composites, angle plied composites, mechanism of composites, calculation of properties, unidirectional fiber composites, critical volume fraction, discontinuous fiber composites, rule of mixtures equation, critical angle.

Unit-2: **(08Hrs)**

Organic Materials: Introduction, Thermoplastics ,Thermosets, Types of Polymers, Mechanical characteristic, Forming Techniques, applications of polymers, plastics and elastomers. Ceramics: Introduction, Classifications, properties, structures, Processing of Ceramics, Refractory materials, electronic ceramics, cement and concrete.

Unit-3: **(04Hrs)**

Miscellaneous Materials: Classification, applications and properties of cutting tool materials, semi conducting materials, dielectric materials, magnetic materials, ferroelectrics materials. Smart materials, Super alloys. Introduction to shape memory alloys and nano materials.

Unit-4: **(08Hrs)**

Advances In Casting Processes: Sheet molding casting V -Process, flask less molding, evaporative casting, plaster mould casting designfor plaster mould casting, quality-accuracy uniformity & other considerations in casting and molding.

Unit-5: **(04Hrs)**

Metallic Coating: Importance, principle, applications of; Chemical vapor deposition, physical vapor deposition, Thermal spray coating, Electro plating, Electro less coating.

Unit-6: **(08Hrs)**

Non-traditional Machining Process: Introduction, Chemical machining, Electro Chemical machining, Electro discharge machining, Wire EDM, Magneto abrasive finishing, Abrasive flow machining, Water jet machining, Micro drilling by different processes like laser beam, ion beam, electro jet, etc, Electro Stream Drilling. Non-traditional Deburring process:
Rapid Prototyping (RP): Principle and elements of RP. Advantages & applications of RP, Introduction to regenerative manufacturing process like SLS, LOM, FDM.

Section – A Unit 1, 2 and 3

Section – B Unit 4, 5 and 6

References:

1) The Nature and Properties of Engineering Materials by Z.D. Jastrezebski.

2) Introduction to Physical Metallurgy by S.H. Avner.
3) Composites Materials by S.C. Sharma.
4) Materials Science and Engineering by R.K. Rajput.
5) Materials and Processes in Mfg. by E.P. DeGarmo, J.T. Black,R.A. Kosher.
6) Modern Manufacturing process Engineering by Benjamin W. Niebel,Allen B. Draper, Richard A. Wysk, McGraw Hill.
7) Non Traditional Manufacturing processes by Garry F. Benedict Marcel, Dekker Inc., New York.
8) Production Technology Hand Book by H.M.T. Tata McGraw Hill.
9) Non Traditional Machining Processes by E.J. Weller, Society of Manufacturing Engineers,Dearban Michigan.
10) Nano material by A.K. Bandyopadyay, New age Publishers.
11) Engineering Mechanics of Composite Materials by Isaac and M Daniel, Oxford University Press.

Pattern of Question Paper:

The units in the syllabus are divided in two equal sections. Question paper consists of two sections A and B. Section A includes first three units (1, 2, and 3) and Section B includes remaining three units (4, 5 and 6). Question paper should cover the entire syllabus.

For 80 marks Paper:

1. Five questions in each Section

2. Question no. 1 and 6 are compulsory for 10 marks each which contains short answer questions of 02 marks each.
3. From remaining four questions, attempt any two questions from each section.

MED – 409 - ELECTIVE II: ADVANCED CAD/CAM

Teaching Scheme

Lectures: 4 Hrs/week

Credit: 4

Examination Scheme

Theory Exam: 80 Marks (3Hrs.)

Class Test: 20 Marks (1Hrs.)

Objectives:
- To give an overview of CAD/CAM technology
- To understand use of computers for manufacturing
- To develop 3D modeling skills required for design and manufacturing
- To understand the basics of surface modeling methods
- To understand different data exchange formats and process planning

UNIT- 1: CAD Tools: **(06 Hrs)**

Definition of CAD Tools, Graphics standards, Graphics software: requirements of graphics software, Functional areas of CAD, Efficient use of CAD software. Basics of Geometric Modeling: Requirement of geometric modeling, Geometric models, Geometric construction methods, Modeling facilities desired.

UNIT- 2: Geometric Modeling: **(06 Hrs)**

Classification of wireframe entities, Curve representation methods, Parametric representation of analytic curves: line, circle, arc, conics, Parametric representation of synthetic curves: Hermite cubic curve, Bezier curve, B-Spline curve, NURBS, Curve manipulations.

UNIT- 3: Surface Modeling: **(08 Hrs)**

Classification of surface entities, Surface representation methods, Parametric representation of analytic surfaces: plane surface, ruled surface, surface of revolution, tabulated cylinder, Parametric

representation of synthetic curves: Hermite cubic surface, Bezier surface, B-Spline surface, Blending surface, Surface manipulations.

Unit – 4: Evaluation Criteria: **(06 Hrs)**

Evaluation criteria of CAD software, Data exchange formats: GKS, IGES, PHIGS, CGM, STEP, Dimensioning and tolerances: Linear, angular, angular dimensions, maximum material condition (MMC), least material condition (LMC), Regardless of feature size (RFS).

UNIT – 5: Computer Aided Process Planning: **(08 Hrs)**

Hybrid CAAP System, Computer Aided Inspection and quality control, Coordinate Measuring Machine, Limitations of CMM, Computer Aided Testing, Optical Inspection Methods, Artificial Intelligence and expert system: Artificial Intelligence in CAD, Experts systems and its structures.

UNIT – 6: Tooling for CNC Machines: **(06 Hrs)**

Interchangeable tooling system, preset and qualified tools, coolant fed tooling system, modular fixturing, quick change tooling system, automatic head changers. DNC Systems and Adaptive Control: Introduction, type of DNC systems, advantages arid disadvantages of DNC, adaptive control with optimization, Adaptive control with constrains, Adaptive control of machining processes like turning, grinding.

Section – A Unit 1, 2 and 3
Section – B Unit 4, 5 and 6

References:

- CAD/CAM Concepts and Applications, Alavala, PHI.
- Mastering CAD/CAM, Ibrhim Zeid, McGraw Hill International.
- CAD/CAM/CIM, Radhakrishnan and Subramanian, New Age.
- Principles of Computer Aided Design and Manufacturing, Farid Amirouche, Pearson.
- CAD/CAM Principles and Applications, P.N. Rao, TMH
- Computer Control of Manufacturing Systems / Yoram Koren / McGraw Hill. 1983.
- Computer Numerical Control Concepts and Programming, Warren S Seames and Thomson.

Section A: Unit 1, 2 and 3
Section B: Unit 4, 5 and 6

Pattern of Question Paper:

The units in the syllabus are divided in two equal sections. Question paper consists of two sections A and B. Section A includes first three units (1, 2, and 3) and Section B includes remaining three units (4, 5 and 6). Question paper should cover the entire syllabus.

For 80 marks Paper:

1. Five questions in each Section

2. Question no. 1 and 6 are compulsory for 10 marks each which contains short answer questions of 02 marks each.
3. From remaining four questions, attempt any two questions from each section.

MED421- LAB-I INTERNAL COMBUSTION (I.C.) ENGINES AND GAS TURBINES

Teaching Scheme

Practical: 2 Hrs/week

Credit: 1

Examination Scheme

Term Work: 25 Marks

Practical Exam: 25 Marks

List of Experiments:

Performing minimum seven experiments out of the following and preparing record of the experiments.

1. Performance test on a single cylinder diesel engine.
2. Performance test on a single cylinder petrol engine.
3. Performance test on a multi-cylinder petrol engine.
4. Study of alternative fuels.
5. Study of Bosch type single plunger fuel pump.
6. Study of various types of fuel injectors and nozzles.
7. Study of different types of carburetor.
8. Study of gas turbines
9. Measurement of exhaust gas emission from S.I. engine.
10. Measurement of exhaust gas emission from CI engine.

Term work:

The term work shall consist of Performing / Studying above mentioned experiments. The candidate shall submit the report of each experiment and the assignments.

Practical Examination:

The Practical Examination will consist of performing an experiment based on practical work done during the course and viva voce based on the syllabus and term work. The practical examination will be assessed by two examiners, one will be the subject teacher and other examiner appointed by Dr. B.A.M.U. Aurangabad.

LAB-II MED 422: AUTOMATIC CONTROL SYSTEM

Teaching Scheme

Practical: 2 Hrs/week

Credit: 1

Examination Scheme

Term Work: 25 Marks

Term Work: Term work shall consist of record book of the following- **Practicals (any 5):**

1. Study of Control System Components
2. An experiment on Speed Control of Stepper motor
3. An experiment on Fluid Level Control System
4. An experiment on ON/OFF temperature controller
5. An experiment on various modes of control action P, I, P+I, P+D, and P+I+D
6. An experiment based on AC/DC Servomotor
7. Practical study of any one control system

Assignments:

1. Four assignments based on syllabus
2. One assignment based on SCILAB/MATLAB programming.

The assessment of term work shall be on the following criteria:

1. Continuous assessment
2. Performing the experiments in the laboratory

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MED423 LAB –III: METROLOGY AND QUALITY CONTROL

Teaching Scheme

Practical: 2 Hrs/week

Credit: 1

Examination Scheme

Term Work: 25 Marks

Practical Exam: 25 Marks

Term Work: Any Four from experiment No. 1 to 6 and Any Four from experiment No. 7 to 12

1) Determination of linear and angular dimensions of given a part using precision/non precision measuring instruments.

2) Error determination with linear / angular measuring instruments.

3) Precision Angular Measurement using Sine bar/sine Center, Autocollimator / Angle Dekkor.

4) Measurement of screw thread using Floating carriage Micrometer.

5) Measurement of Gear Tooth thickness by Gear tooth Vernier Caliper / Constant chord / Span micrometer

6) Interferometer – Study of Surfaces using Optical flat.

7) Study and application of Profile projector and Tool Maker's Microscope.

8) Inspection of Production job by Statistical Process control.

9) Assignment on Acceptance Sampling.

10) Case Study of ISO system Implementation.

11) Machine Tool alignment test on any two Machines like – Lathe, Drilling, Milling

12) Industrial visit to Calibration lab /Quality control lab / Gear manufacturing unit / Automotive Industry / Engineering Industry.

Term work:
The term work shall consist of Performing / Studying above mentioned experiments. The candidate shall submit the report of each experiment and the assignments.

Practical Examination:
The Practical Examination will consist of performing an experiment based on practical work done during the course and viva voce based on the syllabus and term work. The practical examination will be assessed by two examiners, one will be the subject teacher and other examiner appointed by Dr. B.A.M.U. Aurangabad.

LAB-IV MED424- ENERGY CONSERVATION AND MANAGEMENT

Teaching Scheme

Practical: 2 Hrs/week

Credit: 1

Examination Scheme

Practical Exam: 25 Marks

Practical:
List of experiments:

1. To study Road map of Jawaharlal Nehru National Solar Mission.
2. To study Basics of Biofuels, Resources for production of Biodiesel and national status.
3. Study of Cogeneration in Sugar Factories.
4. Visit to Glass Industry/Paper Mills etc.
5. Study Energy for transportation through e-vehicle development
6. Visit to Roof top Solar Photovoltaic Establishment/Agriculture water pumping station
7. Trial Energy audit of household/laboratory/paper industry/glass industry etc
8. Financial calculation of replacing old equipment with energy efficient appliances.
9. Study on Investment of Renewable Energy Systems e.g. Solar Water Heater/PV system etc.

Note: Any Six experiments from above list should be performed out of which at least one visit to Solar Water Pump/Solar PV system/Sugar Factory/Paper Mill/Glass Factory to be conducted.

Practical Examination:

The practical examination shall be consisting of Viva-Voce based on the study carried out and practical visits to various establishments mentioned as per the syllabus.

SEMINAR

Teaching Scheme

Practical: 2 Hrs/Week

Credit: 2

Examination Scheme

Term Work: 50 Marks

Every individual student shall work on a recent topic selected or assigned from any engineering/allied/applied fields for the seminar of academic or industrial interest. It is expected that the student has to collect information on a topic which is not covered in curriculum of the under graduate course. Student has to refer hand book, research journals, reference books, proceeding of conference through library or internet and record of references considered for seminar is to preserved in hard copy or soft copy, which shall be produced at the time of seminar.

The report of seminar should be submitted in printed volume duly certified by guide, HOD and Principal in prescribed format given below. The student should deliver a seminar talk at leastnfor 20 minutes based on the work done by him/her. The performance will be judged by his guide and another expert appointed by HOD.

INSTRUCTIONS TO PREPARE REPORT AND PPT

1. Seminar report shall be typed on A-4 size white bond paper.
2. Typing shall be with line spacing of 1.5using black inkjet print on one side of the paper.
3. Margins a) Left 37.5mm b) Right, Top and Bottom 25mm.
4. Page number - At the bottom center aligned 12 point font size.
5. Header and Footer (12 point font size - Times New Roman)

a) Header - Right side at top stating title of the seminar.

b) Footer - Right side at bottom stating institute name.

6. Font

a) Main title font - 14 point - bold - Times New Roman - Upper case

b) Sub title font - 12 point - bold - Times New Roman - Title case
c) Text font - 12 point - normal - Times New Roman - Running
d) Graph / Figure / Table titles - 12 point - normal - Times New Roman - Title case
7. Graph / Figure / Table: - shall be located at the center along with its title and Graph No. / Figure No. / Table No.
If Graph / Figure / Table or any information is copied from any of the references, reference no. is to be shown at the end of its title / statement in square bracket superscripted form
8. Seminar report shall consists of at least following contents
a. First page.
b. Certificate.
c. Acknowledgement.
d. Index page (Chapter wise)
e. Graph index (Graph no., Title, Page no.)
f. Figure index (Figure no., Title, Page no.)
g. Table index (Table no., Title, Page no.)
h. Introduction /Abstract of seminar.
i. Literature review.
j. Core content of seminar.
k. Merits and demerits of subject.
l. Future scope.
m. Conclusion.
n. References.
o. Appendix
p. Compact Disc.
9. Format of seminar report
a. First page (Title page) and cover of seminar report.

(Institute logo)
Seminar Report
on
"Title of Seminar"
By
Name of student
Submitted in partial fulfillment of the requirement for the degree of
Bachelor of Engineering (Mechanical)
Department of Mechanical Engineering
Name of Institute
Year 2019-20

b. Certificate

(Institute logo)
CERTIFICATE

This is to certify that the seminar report entitled

"Title of Seminar"

Submitted by

Name of student

has completed as per the requirement of Dr. Babasaheb Ambedkar Marathwada University in partial fulfillment of degree B.E.(Mechanical)

Guide (Name)	**Head of Department** (Name)	**Principal** (Name)

Department of Mechanical Engineering

Name of Institute

Year 2019-20

c. Acknowledgement:- Acknowledgement shall consists of students opinion related to the seminar topic and his gratitude towards his guide, other staff, social members and his friends those who have really helped him to complete seminar report.

d. Chapter Index: - Shall have title as "INDEX" in bold - 14 point aligned at top center and page consisting of table with three columns as Chapter No., Chapter particulars, and Page No. Chapter No. and Page No shall be aligned at center of cell and chapter particulars left aligned in the cell.

e. Graph Index / Figure Index / Table Index: - Shall have title as "GRAPH INDEX / FIGURE INDEX / TABLE INDEX" in bold - 14 point center aligned at top of page. Page consisting of three column table as Graph No. / Figure No. / Table No. in first column, Title of Graph / Figure / Table in second column and Page No. in third column. (Similar to chapter index.)

10. Sketches:-Shall be drawn on separate sheet, center aligned with Figure No. and Title of sketch at its bottom.

11. Table shall preferably be typed in text format only with table no. and its title at the top, centrally aligned.

12. Standard mathematical symbols and notations shall be used.

13. The last item on Index should be references.

14. Compact Disc (C.D.) consisting of soft copy of seminar report, PPT, and supporting literature shall be affixed at back cover of report.

15. Presentation shall be made with help of Power point.

a. Preferably each slide shall have plain white or faint yellow or navy blue or maroon colored back ground with contrast matching font.

b. Each slide shall be numbered and header - footer shall be added similar to report.

c. Figure / Graph / Table shall be labeled with Figure No. / Graph No. / Table No. and with reference nos. shown in seminar report

d. Only brief points are to be highlighted on slides

e. Information copied from references shall be numbered with reference number.

f. Points are not to be read directly from slide at the time of presentation.

g. Presentation shall be based on Figure, Graph, Table, Charts and points etc.

h. First slide shall be identical to cover page of report.

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i. Second slide should contain introduction / abstract of seminar and content of presentation with bullets.
j. Third slide shall focus on literature review.
k. Fourth slide on wards core content of presentation shall be discussed.
l. Slides at the end shall consist of merits, demerits, future scope, conclusion and references.

The Term work marks for seminar will be allotted based on the following

1. Seminar Report 10 Marks
2. Literature Review 08 Marks
3. Technical Content 10 Marks
4. Presentation Skill (Aids used) 14 Marks
5. Question Answer 08 Marks

Total 50 Marks

PROJECT-I

Teaching Scheme

Practical: 2 Hrs/Week

Credit: 2

Examination Scheme

Practical Exam: 50 Marks

1. Every student or group of maximum Five students should undertake a project work under the guidance of teacher allotted.

2. The project work could be theoretical work on trouble shooting, design, development, fabrication of prototype / model, Implementing a research paper or application of advanced software.

3. Preferably project shall be useful to the general community such as rural, former community and small scale industry etc.

4. If the project is based on software, it shall impart sufficient knowledge of software and its application to the students. The software used should not be among the software recommended in undergraduate curriculum. It should be entirely new to the students.

5. If the project is based on fabrication, it shall be supported by design and development.

6. It is essential that the student/s should concentrate on need, feasibility, economy, usefulness, effects on environment and global warming.

7. The student/s should get their project topic approved by the project committee under the leadership of project in charge / HOD appointed by Principal.

8. Student has to collect information from hand book, research journals, reference books, proceeding of conference through library or internet.

9. Student/s should prepare a spiral bound report with detail schedule of activities planned for completion of project and its presentation similar to the seminar report and shall be presented by all the partners dividing presentation among them at the time of examination in presence of guide and external examiner.

10. It is compulsory to continue with same project in next semester and copy of report shall be produced at the time of final dissertation. Theme of project defined in 7th semester and its achievement must be compared.

11. Students shall prepare paper / project to participate in State level / National / International competition. The projects participated shall get additional benefit in final semester based on certificate of participation.

The practical examination shall be based on presentation and marks shall be allotted on following points.

1. Report 5 Marks.

2. Literature Review 5 Marks.

3. Technical Content 5 Marks.

4. Regency of topic 5 Marks.

5. Usefulness 5 Marks.

6. Feasibility 5 Marks.

7. Presentation 5 Marks.

8. Economy 5 Marks.

9. Merits 5 Marks.

10 Question / Answer 5 Marks.

Total 50 Marks

SEMESTER-VIII

MED451-AUTOMOBILE ENGINEERING

Teaching Scheme

Lectures: 4 Hrs/Week

Credit: 4

Examination Scheme

Theory Exam: 80 Marks (3 Hrs)

Class Test: 20 Marks (1 Hr)

Objectives - Students understand the fundamentals of Automobile Engineering.

Course Contents:

Unit-1: **(04Hrs)**

Introduction: Classification of automobiles, main components of automobile. Layout of with different engine positions and drive arrangements. Types of engines and other power plants used in Automobile. Recent developments in engines. Engine selection criteria. Chassis and Super structure (Body).

Unit-2: **(10Hrs)**

Transmission System: Clutches: Purpose of clutch, classification, single plate clutch coil spring, diaphragm spring and semi centrifugal clutch, clutch plates. Multiple plate clutches, centrifugal clutch. Gearbox: Function, various resistances, tractive effort, performance curves. Sliding mesh gear arrangement, constant mesh gear arrangement and synchromesh arrangement, epicyclic gears, layout of gear arrangement in a gearbox for forward and reverse gears, over drive. Gear selector mechanisms. Automatic transmission- types, torque converter. Differential and their types. Propeller shaft, universal joints.

Unit-3: **(06Hrs)**

Suspension System: Objectives, various types of springs and shock absorbers used in suspension. Rigid axle suspension system, H frame twist-beam rear suspension (used in recent cars), independent suspension systems- Wish bone parallel link, Mac-Pherson strut and trailing arm suspension. Air

suspension. Telescopic suspension in two wheelers. Stabilizer or anti roll bar. Introduction to electronic suspension, ride control and active suspensions.

Unit-4: **(08Hrs)**

Axle, Steering System and Tyres: Front axle types, final drive, rear axle arrangements. Steering geometry, caster, camber, toe-in toe-out, included angle, scrub radius, turning radius, thrust angle. Effects of these angles. Wheel alignment and wheel balancing. Under steer, over steer. Steering system, steering columns, steering effort, components of steering system (one with gear box and tie rods and another with rack and pinion), Various types of steering gearboxes. Power steering- hydraulic and electronic. Wheels: Wheel rims. Tyres – function, construction, types of tyres, tubeless tyres.

Unit-5: **(06Hrs)**

Braking Systems: Purpose, classification. Drum and disc brake systems, brake shoes, leading- trailing drum brake. Mechanical brakes, hydraulic brake system- layout, tandem master cylinder, slave cylinders. Air brake systems.Antilock brake systems (ABS).Parking brakes.

Unit-6: **(06Hrs)**

Automotive Electricals And Additional Systems: Ignition system, starting systems, charging system, dashboard instruments. Electrical and electronics in the doors.(window, central locking, etc) Automobile air-conditioning systems. Safety systems in automobile. Pollution control norms and pollution control devices.

Section – A Unit 1, 2 and 3
Section – B Unit 4, 5 and 6

References:

1 Automotive Mechanics by Crouse &Anglin, Tata McGraw Hill.
2 Automotive Mechanics by Joseph Heitner, C.B.S.Publisher and Distributors
3 Automobile Engineering by R.K.Rajput, Luxmi Publications.
4 Automobile Engineering, Vol.I& II by K.K.Jain ,R.B.Asthana, McGraw Hill Education (India)

Pattern of Question Paper

The units in the syllabus are divided in two equal sections. Question paper consists of two sections A and B. Section A includes first three units (1, 2, and 3) and Section B includes remaining three units (4, 5 and 6). Question paper should cover the entire syllabus.

For 80 marks Paper:

1. Five questions in each Section
2. Question no. 1 and 6 are compulsory for 10 marks each which contains short answer questions of 02 marks each.

03. From remaining four questions, attempt any two questions from each section.

MED 452-PROJECT MANAGEMENT AND OPERATIONS RESEARCH

Teaching Scheme

Lectures: 4 Hrs/Week

Credit: 4

Examination Scheme

Theory Exam: 80 Marks (3 Hrs)

Class Test: 20 Marks (1 Hr)

Objectives:

- To create awareness about optimization in utilization of resources.
- To understand and apply operations research techniques to industrial operations and Institutes.

Course Contents:

Unit 1: **(14Hrs)**

Introduction: Operations research development, history, definitions, objectives, characteristics, limitations, phases and applications.

Linear Models: Formation of an L.P model, graphical solution, simplex algorithm, artificial variables technique– Big M method, two phase method, Duality in LPP.

Unit 2: **(06Hrs)**

Transportation Problems: Introduction, Methods for finding initial solution, Test of optimality, Maximization and Minimization Transportation problems, Transshipment problems, Degeneracy.

Unit 3:

Assignment Problems: Introduction, Solution methods, Variations of the assignment problem, Traveling salesman problem.

Replacement Models: Replacement of items that deteriorates with time, Value of money changing with time and not changing with time, Optimum replacement policy , Individual and group replacement.

Unit 4: **(05Hrs)**

Queuing Theory: Queuing models, queuing systems and structures, notation, parameter, single server and multiserver models, Poisson input, exponential service, constant rate service, infinite population.
Sequencing Models: Scheduling and sequencing, assumptions in sequencing models, processing 'n' jobs on 'm' machines, processing of two jobs on machines with each having different processing order.

Unit 5: **(08Hrs)**

Game Theory: Introduction, Two-person zero-sum game, Minimum and Maximum principle, Saddle point, Methods for solving game problems with pure and mixed strategies.
Inventory Models: Types of Inventory, EOQ, ERL, Deterministic inventory problems, Price breaks, stochastic inventory problems and Selective inventory control techniques.

Unit 6: **(07Hrs)**

Network Models: Introduction to PERT/CPM & its importance in project management, Concept & construction of network diagrams, Critical path & project duration, floats, network crashing, optimum project duration & cost, PERT activity, time estimate, probability of completion of a project on or before specified time.

Section – A Unit 1, 2 and 3
Section – B Unit 4, 5 and 6

References:

1. Wayne.L.Winston, Operations research applications and algorithms, Thomson learning,4th edition 2007.
2.Taha H.A, "Operation Research", Pearson Education sixth edition, 2003
3. S. D. Sharma, "Introduction to Operations Research", Discovery Publishing House, New Delhi
4. P. K. Gupta, D. S. Hira, "Operations Research", S Chand and Co. Ltd., ISBN 81-219-0281-9.

Journals/Magazines:

1. Frederick.S.Hiller and Gerald.J.Lieberman, "Operations Research Concepts and Cases", TMH (SIE) 8th Edition.
2. J.K.Sharma, "Operations research theory and applications", Macmillan India .3rd Edition 2007,
3. Hira and Gupta " Problems in Operations Research", S.Chand and Co,2002.
4. Panneerselvam, "Operations Research" Prentice Hall of India, 2003.
5. G Srinivasan, "Operations research principles and applications", PHI (EEE) 2007.
6. Wagner, "Operations Research", Prentice Hall of India, 2000.

Pattern of Question Paper

The units in the syllabus are divided in two equal sections. Question paper consists of two sections A and B. Section A includes first three units (1, 2, and 3) and Section B includes remaining three units (4, 5 and 6). Question paper should cover the entire syllabus.

For 80 marks Paper:

1. Five questions in each Section
2. Question no. 1 and 6 are compulsory for 10 marks each which contains short answer questions of 02 marks each.
03. From remaining four questions, attempt any two questions from each section.

MED453-REFRIGERATION AND AIR CONDITIONING

Teaching Scheme

Lectures: 4 Hrs/week

Credits: 4

Examination Scheme

Theory: 80Marks (3Hrs.)

Class Test: 20 Marks (1Hrs.)

Objective:

1. Understand the basic thermodynamic cycles in refrigeration.
2. Understanding and analyzing modern variants of the vapor compression & absorption systems in refrigeration.
3. Apply psychromertic analysis to various air conditioning systems.

Course Content:

Unit-1: Introduction and Simple Vapour Compression cycle **(08Hrs)**

A. Introduction: Fundamentals of thermodynamics, Refrigerator, heat pump, coefficient of performance, unit of refrigeration, Exegetic efficiency, Carnot cycle for refrigeration and its performance.

B. Simple Vapour Compression Cycle: Modification of Carnot cycle, vapor compression cycle and its components, representation on T-s and P-h planes. Effect of operating condition on performance of VCC, sub cooling & superheating of refrigerant, methods to improve cop of VCC, regeneration and its importance in VCC, actual VCC.

Unit-2: Multistage Vapour Compression Cycle **(06Hrs)**

Multistage Vapour Compression Cycle: Limitations of simple VCC for achieving low temperatures, intercooling, popular arrangements of intercooling with multi compression; multi evaporator system; individual compressors, compound Compression; cascade systems.

Unit-3: Gas Cycle Refrigeration **(06Hrs)**

Gas Cycle Refrigeration: Comparison of air refrigeration with VCC, components, Bell Coleman cycle, regenerative BCC, Necessity of aircraft refrigeration; Advantages of air cycle for aircraft refrigeration, classification of aircraft refrigeration system and their analysis; Dry air rated temperature (DART).

Unit-4: Vapour Absorption System **(06Hrs)**

Vapour Absorption System: Principal of absorption system; common refrigerant absorbentpairs; comparison between absorption and compression system; simple absorption system; modification to simple vapour absorption system; Use of temperature concentration diagram (T - C) and enthalpy concentration diagram (h-c) Lithium- Bromide water vapour absorption system.

Unit-5: Psychrometry **(09Hrs)**

A. **Introduction to Psychromaetry:** Psychrometry and Air composition, psychometricproperties, psychometric relations, Adiabatic saturation and thermodynamic wet bulb temperature; psychomotor

B. **Applied Psychrometry:** Psychometric processes: its representation psychometric chart; Adiabatic mixing of air streams; coil bypass factor, Air conditioning process; ADP, ventilation and infiltration. Use of Air conditioning calculation format.

Unit-6: Refrigerants and Application of Refrigeration And Air Conditioning **(05Hrs)**

A. **Refrigerants:** Properties of refrigerants; classification of refrigerants, Designation ofrefrigerants; Selection of refrigerants; ODP and GWP of CFC's refrigerants; substitutes for CFC refrigerants, Azeotropic mixtures, Secondary refrigerants.

B. **Application of Refrigeration and Air Conditioning:** Domestic refrigerator, water cooler, Ice plant, cold storage, Steam jet refrigeration system, defrosting in refrigerators, Mine air conditioning and ventilation.

Section – A Unit 1, 2 and 3
Section – B Unit 4, 5 and 6

References:

1. Refrigeration and Air conditioning by Arora C.P, Tata McGraw Hill Pub.1985.
2. Refrigeration and Air conditioning by P. L. Ballaney, Hanna pub.
3. Refrigeration and Air conditioning by Manohar Prasad, Wiley Eastern pub.
4. Refrigeration and Air conditioning by Domkundwar, DhanpatRai Pub. 1998.
5. Principles of Refrigeration by Dossat R.J, Prentice Hall pub.1997.
6. Refrigeration and Air conditioning by, Anantnarayan, Tata MC Graw Hill Pub.1987.
7. Refrigeration and Air conditioning by Jain V. K.
8. ASHARE: Handbook.
9. Air-conditioning System Design- Handbook, Carrier corp, USA.
10. Heating, Ventilating and Air conditioning by McQuiston, Wiley publication,2005.

Pattern of Question Paper

The units in the syllabus are divided in two equal sections. Question paper consists of two sections A and B. Section A includes first three units (1, 2, and 3) and Section B includes remaining three units (4, 5 and 6). Question paper should cover the entire syllabus.

For 80 marks Paper:

1. Five questions in each Section
2. Question no. 1 and 6 are compulsory for 10 marks each which contains short answer questions of 02 marks each.
03. From remaining four questions, attempt any two questions from each section.

MED 454 – ELECTIVE-III: FINITE ELEMENT ANALSIS

Teaching Scheme

Lectures: 4 Hrs/Week

Credit: 4

Examination Scheme

Theory Exam: 80 Marks (3 Hrs)

Class Test: 20 Marks (1 Hrs)

Objectives:

- To familiarize students with the displacement-based finite element method for displacement and stress analysis.
- To study approximate nature of the finite element method and convergence of results are examined.
- It provides some experience with a commercial FEM code and some practical modeling exercises.

Unit 1: Introduction **(4 Hrs)**

Finite element analysis and its need, Finite element Terminology, Advantages and Limitations of finite element analysis (FEA), FEA procedure, Application of FEA in various fields,

Unit 2: Fundamental Concepts of FEA **(8 Hrs)**

Review of Solid Mechanics stress equilibrium equations, Strain-Displacement equations Plane stress and Plane strain and axi-symmetric problems. Essentials and natural boundary conditions. Review of Matrix Algebra. Inverse of matrix, Eigen value and eigen vectors, Introduction to different approaches used in FEA such as direct approach, variational approach, weighted residual, energy approach, Galerkin and Raleigh Ritz approach.

Unit 3: One dimensional Element **(8 Hrs)**

Types of 1D element, Global and local coordinate system, order of element, primary and secondary variables, shape function and its properties. Formulation of element stiffness matrix and load vector for

springs, bar, beam, truss and plane frame. Transformation matrix for truss and plane frame , Assembly of global stiffness matrix and load vector.

Unit 4: Two dimensional Elements **(7 Hrs)**

Types of 2D element, Formulation of elemental stiffness matrix and load vector for plane stress/strain such as Linear Strain Rectangle (LSR), Constant Strain Triangle(CST), Pascal's tringle, properties of shape function, Assembly of global stiffness matrix and load vector.

Unit 5: Steady state heat transfer problem **(6 Hrs)**

Introduction, Governing differential equation, steady-state heat transfer formulation of 1D element for conduction and convection problem, boundry conditions and solving for temperature distribution.

Unit 6: Dynamic analysis **(7 Hrs)**

Types of dynamic analysis, General dynamic equation of motion, point and distributed mass, lumped and consistent mass, Mass matrix formulation of bar and beam element. Undamped-free vibration-Eigenvalue problem, Evaluation of eigen values and eigenvectors (natural frequencies and mode shapes.

Section – A Unit 1, 2 and 3
Section – B Unit 4, 5 and 6

Refernece Books:

1. T. R. Chandrupatla, A. D. Belegundu, "Introduction to Finite elements in Engineering", Prentice Hall of India Pvt. Ltd., 3rd edition, New Delhi.
2. P. Seshu, " A Textbook of Finite Element Analysis" Prentice Hall of India Pvt. Ltd., New Delhi.
3. R. D. Cook, D. S. Malkus, M. E. Plesha, R. J. Witt, "Concepts and Applications of Finite Element Analysis", John Wiley & Sons, Inc.
4. K. J. Bathe, "Finite Element Procedures", Prentice Hall of India Pvt Ltd.

Pattern of Question Paper

The units in the syllabus are divided in two equal sections. Question paper consists of two sections A and B. Section A includes first three units (1, 2, and 3) and Section B includes remaining three units (4, 5 and 6). Question paper should cover the entire syllabus.

For 80 marks Paper:

1. Five questions in each Section
2. Question no. 1 and 6 are compulsory for 10 marks each which contains short answer questions of 02 marks each.
03. From remaining four questions, attempt any two questions from each section.

MED 455- ELECTIVE-III: AEROSPACE ENGINEERING

Teaching Scheme

Lectures: 4 Hrs/Week

Credit: 4

Examination Scheme

Theory Exam: 80 Marks (3 Hrs)

Class Test: 20 Marks (1 Hrs)

Objectives: Course content

Unit 01: Introduction of Aerospace Engineering **(02 Hrs)**

Introduction: Components of an aircraft, Types of aerial vehicles.

Unit 2: Basic Aerodynamics: **(10 Hrs)**

Fluid dynamic equations & their basis, Ideal fluid, viscous flows, Flow past a body, Flow Separation, Generation of Lift, Drag & Moment, Nondimensional coefficients, Airfoils & Wings, Airfoil families, Supersonic flight, Wave Drag, Aircraft Drag Polar (Discriptive only)

Unit3: Aircraft Performance: **(8 Hrs)**

Types of Powerplant for aerospace vehicles, Thrust/Power and fuel flow variation with altitude & velocity. Steady level flight, Altitude effects, Absolute ceiling, steady climbing flight, Energy methods, Range and Endurance, Sustained level turn, pullup, Take-off and Landing. (Discriptive only)

Unit4: Aerospace Propulsion **(10 Hrs)**

Introduction, Various propulsive devices used for aerospace applications. Classifications of rockets: Electric, Nuclear and Chemical rockets, Applications of rockets.

Nozzle design: Flow through nozzle, Real nozzle, Equilibrium and frozen flow, Adaptive and non-adaptive nozzles. Thrust vector controls, Rocket performance parameters. Solid propellant rockets, Grain compositions. Design of grain. Liquid propellant rockets, Injector design, cooling systems,

Feed Systems: Pressure feed and turbo-pump feed system. Heat transfer problems in rocket engines. (Discriptive only)

Unit 5: Aircraft Design: **(6 hrs)**

Introduction to Aircraft Design: Three phases in aircraft design, Computer based aircraft design methodologies, differences between LTA and HTA aircraft, type of civil and military aircraft. (Discriptive only)

Unit 6: Aerodynamics **(4 hrs)**

Airfoils, wings and their nomenclature, lift, drag and pitching moment coefficients, centre of pressure and aerodynamic centre. (Discriptive only)

References:

1. Anderson, J. D., The Aeroplane, a History of its Technology, AIAA Education Series, 2002

2. Anderson, J. D., Introduction to Flight, McGraw-Hill Professional, 2005

3. Ojha S.K., Flight Performance of Aircraft, AIAA Education Series, 1995

4. Raymer, D. P., Aircraft Design - A Conceptual Approach, AIAA Educational Series, 4th Ed., 2006.

5. Brandt, S. A., Stiles, R. J., Bertin, J. J., Whitford, R., Introduction to Aeronautics: A Design Perspective, AIAA Educational Series, 2nd ed., 2004.

6. Jenkinson, L. R., Simpkin, P. and Rhodes, D., Civil Jet Aircraft Design, Arnold Publishers, London, 1999.

7. Oates, G. C., Aerothermodynamics of Gas Turbine and Rocket Propulsion, AIAA, 1988.

8. Hill, P., and Peterson, C., Mechanics and Thermodynamics of Propulsion, ISBN 978 0132465489, Pearson Education, 2009.

Pattern of Question Paper

The units in the syllabus are divided in two equal sections. Question paper consists of two sections A and B. Section A includes first three units (1, 2, and 3) and Section B includes remaining three units (4, 5 and 6). Question paper should cover the entire syllabus.

For 80 marks Paper:

1. Five questions in each Section
2. Question no. 1 and 6 are compulsory for 10 marks each which contains short answer questions of 02 marks each.
03. From remaining four questions, attempt any two questions from each section.

MED456- ELECTIVE-III: INDUSTRIAL ENGINEERING

Teaching Scheme

Lectures: 4 Hrs/Week

Credit: 4

Examination Scheme

Theory Exam: 80 Marks (3 Hrs)

Class Test: 20 Marks (1 Hrs)

Objectives: At the completion of the course, students should be able to:

- Construct operations process charts, models and diagrams for manufacturing and operations planning.
- Use flow process charts, time study and occurrence sampling for methods improvement and work measurement applications.
- Perform job evaluation and merit rating, Kaizen and SMED.
- Students are expected to understand various concepts in Industrial Engineering.

UNIT 01: INTRODUCTION **(03Hours)**

Productivity, definitions of work study, scope, applications, relationship, between productivity & standard of living, basic work content, excess work content, Management, techniques to reduce excess work content due to product process and ineffective time in control of workers and Management.
(Numerical and Cases on Productivity)

UNIT 02: WORK STUDY **(03Hours)**

Definition, concept, and relation with Productivity, human factors, work study versus Management, supervisor, and work study man, qualities of work study man, working conditions, prevention accidents and hazards.

UNIT 03: METHOD STUDY **(07Hours)**

Definition, objectives, procedure of method study, selection of job, recording techniques, micro-memo motion study, developing new layout materials handling its principles and equipment, movement of workers and materials in working area, string diagram and its significance, multiple activity chart and

their significance, two handed process chart, principles, therbligs, SIMO chart, cycle graph in method study. Critical examination, installation and maintain of proposed method. (***Review of Cases in Method Study)***

UNIT 04: MOTION ECONOMY AND ERGONOMICS PRACTICES **(05Hours)**

Motion Economy principles. Introduction to ergonomics, man/machine/environment systems concept. Design approach: A new design, modification of existing design, assessment of a design, limitations of man and machine with respect to each other, Posture – standing at work, seated at work, work station heights and seat geometry. Human anthropometry and its use in work place layout.
(Work Efficiency and Ergonomics, Effect of Light, Noise, Temperature on Human Performance)

UNIT 05: TIME STUDY **(04Hours)**

Technique, Purpose, use and basic procedure time study equipment selection of jobs for time study, approach to workers, and steps in time study, data collection about jobs, operator & surroundings breaking down jobs into elements, types of elements, selection and measurement of each element. Time study rating and allowances. ***(Numerical and Cases on time study)***

UNIT 06: WORKS MEASUREMENT TECHNIQUES **(06Hours)**

Work sampling - need, establishing confidence levels, determination of sample size, random observation, and conduct of study. General study of standard data, PMTS and MTM. Methods of Improving Materials Productivity, factors affecting materials productivity. Measuring work by physiological methods – heart rate measurement – measuring oxygen consumption– establishing time standards by physiology methods.***(Comparison between Time Study, Work Sampling & MTM)***

UNIT 07: JOB EVALUATION AND MERIT RATING **(02Hours)**

Different techniques of job evaluation and Merit rating. Merits, Demerits, Significance of Job evaluation / merit rating with work measurement.

UNIT 08: KAIZEN **(03Hours)**

Kaizen concept, Kaizen umbrella for quality improvement. Kaizen and management, implications of QC for Kaizen, kaizen and TQC, Kaizen and suggestion systems, Kaizen and competition, Kaizen and innovation, measurement, PDCA cycle. (***Review of Cases in Kaizen)***

UNIT 09: JUST IN TIME **(05 Hours)**

Concept, scope, objectives, push & pull system, reduced inventories and improved set up times, TOYOTA production system, basic assumptions of TOYOTA production system, leveling, smoothing out the production system, JIT and automation. Introduction to Business Process Reengineering, MOST. ***(Review of Cases in JIT)***

UNIT 10: SINGLE MINUTE EXCHANGE OF DIES (SMED) **(02Hours)**

Aspects of setup activities, internal and external setup. Setup improvement, conceptual stages. Techniques for, streamlining the aspect of set up, effects of SMED.

REFERENCES:

1. Work Measurement and Methods Improvement, Lawrence S. Aft, John Wiley and Sons, New York, 2000

2. Work Design and Industrial Ergonomics, Konz & Johnson, Holcomb Hathaway, 2000
3. Motion and Time Study – Design and Measurement of Work, Barnes, Raeph.m. John Wiley &sons, New York, 1990.
4. Human Factors in Engineering and Design, Mc.Cormick, E.J., Mc.Graw Hill.
5. Introduction to Work study, ILO, Geneva.
6. Human Factors Engineering and Design, M. S. Sanders and Ernest J. McCormick, McGraw-Hill Inc.
7. Hand Book of Industrial Engineering by Irson & Grant
8. Just In Time by David Hukins.
9. Kaizen (Ky'zen), the key to Japan's competitive success, Masaaki Imai, McGraw-Hill, 1986.

Pattern of Question Paper:

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For 80 marks Paper:

1. Five questions in each Section.
2. Question no.1 and 6 are compulsory for 10 marks each which contain short answer questions of 02 marks each.
3. From remaining four questions, attempt any two questions from each section.

MED457- ELECTIVE-III: COMPUTATIONAL FLUID DYNAMICS

Teaching Scheme

Lectures: 4 Hrs/Week

Credit: 4

Examination Scheme

Theory Exam: 80 Marks (3 Hrs)

Class Test: 20 Marks (1 Hrs)

Objectives:

- To introduce fundamentals of fluid dynamics
- To introduce concept of FEM

Unit – 1: Fundamental Concepts **(07Hrs)**

Introduction - Basic Equations of Fluid Dynamics - Incompressible inviscid Flows: Source, vortex and doublet panel, methods - lifting flows over arbitrary bodies. Mathematical properties of Fluid Dynamics Equations - Elliptic, Parabolic and Hyperbolic equations - Well posed problems - discretization of partial Differential Equations. Explicit finite difference methods of subsonic, supersonic and viscous flows.

Unit -2: Grid Generation and Discretization **(08Hrs)**

Structured grids, Types and transformations, Generation of structured grids, Unstructured grids. Delany triangulation. Boundary layer equations and methods of solution - Implicit time dependent methods for inviscid and viscous compressible flows - Concept of numerical dissipation – Stability properties of explicit and implicit methods - Conservative upwind discretization for Hyperbolic systems - Further advantages of upwind differencing

Unit – 3: Finite Element Techniques **(05Hrs)**

Overview of finite element techniques in computational fluid dynamics. Strong and Weak formulations of a boundary value problem.

Unit – 4: Finite Volume Techniques **(08Hrs)**

Finite Volume Techniques - Cell Centered Formulation - Lax - Vendoroff Time Stepping -Runge - Kutta Time Stepping - Multi - stage Time Stepping - Accuracy -. Cell Vertex Formulation - Multistage Time Stepping - FDM -like Finite Volume Techniques – Central and Up - wind Type Discretizations - Treatment of Derivatives. Flux – splitting schemes.Pressure correction solvers – SIMPLE, PESO. Vorticity transport formulation.Implicit/semi-implicit schemes.

Unit – 5: Heat Conduction **(06Hrs)**

Finite difference and finite volume formulation of steady/transient one-dimensional conduction equation, source term linearization, incorporating boundary conditions, finite volume formulations for two and three dimentional conduction problems

Unit –6: Convection and Diffusion **(06Hrs)**

Finite volume formulation of steady one-dimensional convection and diffusion problems, central, upwind, hybrid and power law schemes-discritization equations for two dimensional convection and diffusion.

Section A: Unit 1, 2 and 3

Section B: Unit 4, 5 and 6

References Books:

1. Ghoshdastidar, P.S., "Computer Simulation of flow and heat transfer", Tata McGraw-Hill Publishing.
2. Philip J. Pritchard, Johan C Leylegian., "Fluid Mechanics", Wily Publication.
3. Fletcher, C.A.J., "Computational Techniques for Fluid Dynamics", Vols. I and II, Springer - Verlag, Berlin, 1988.
4. Muralidar k and Biswas "Advanced Engineering Fluid Mechanics ". Narosa publishing house New delhi 1995.
5. John F. Wendt (Editor), "Computational Fluid Dynamics - An Introduction", Springer – Verlag, Berlin, 1992.
6. Charles Hirsch, "Numerical Computation of Internal and External Flows", Vols. I and II. John Wiley & Sons, New York, 1988.
7. Anderson, Jr.D. "Fundamentals of Aerodynamics", McGraw-Hill, 2000.
8. Patankar S.V "Numerical heat transfer and fluid flow"McGraw hill 1980.
9. Jagdeesha .T., Thammaiah Gowad, " Fluid Power", Wily Publication. Pattern of Question

Pattern of Question Paper:

The units in the syllabus are divided in two equal sections. Question paper consists of two sections A and B. Section A includes first three units (1,2 and 3) and Section B includes remaining, three units (4, 5 and 6). Question paper should cover the entire syllabus.

For 80 marks Paper:

1. Five questions in each Section.
2. Question no.1 and 6 are compulsory for 10 marks each which contain short answer questions of 02 marks each.
3. From remaining four questions, attempt any two questions from each section.

MED458 - ELECTIVE-III: TRIBOLOGY

Teaching Scheme

Lectures: 4 Hrs/Week

Credit: 4

Examination Scheme

Theory Exam: 80 Marks (3 Hrs)

Class Test: 20 Marks (1 Hrs)

Objectives:

- To develop a solution oriented approach by in depth knowledge of Industrial Tribology
- To address the underlying concepts, methods and application of Industrial Tribology

Course Content:

UNIT 1: INTRODUCTION (06 Hrs)

Defining Tribology, Tribology in Design - Mechanical design of oil seals and gasket - Tribological design of oil seals and gasket, Tribology in Industry (Maintenance), Defining Lubrication, Basic Modes of Lubrication, Properties of Lubricants, Lubricant Additives
Defining Bearing Terminology - Sliding contact bearings - Rolling contact bearings.

UNIT 2: FRICTION (06 Hrs)

Friction - Laws of friction - Friction classification - Causes of friction, Theories of Dry Friction, Adhesion Theory, Abrasive Theory, Junction Growth Theory, Friction Measurement, Stick-Slip Motion and Friction Instabilities.

UNIT 3: WEAR (08 Hrs)

Wear - Wear classification - Wear between solids - Wear between solid and liquid - Factors affecting wear - Measurement of wear.
Wear Mechanisms, Theories of Wear, Adhesive Wear, Abrasive Wear, Corrosive Wear, Fretting Wear, Approaches to Friction Control and Wear Prevention.

UNIT 4: LUBRICATION AND LUBRICANTS (06 Hrs)

Importance of Lubrication, Boundary lubrication, Mixed Lubrication, Full Fluid Film Lubrication classic Hydrodynamics, Hydrostatic and Elasto-hydrodynamic lubrication, Functions of lubricants, Types of lubricants and their industrial uses, SAE classification, properties of liquid and grease lubricants, lubricant additives, general properties and selection.

UNIT 5: HYDRODYNAMIC LUBRICATION **(08 Hrs)**

Principle of Hydrodynamic lubrication, Mechanism of pressure development in oil film, Two Dimensional Reynolds's Equation and its Limitations,Effects of side leakage,Idealized Bearings, Designing Journal Bearing - Sommerfeld number, Raimondi and Boyd method,Petroff's Solution. Parameters of bearing design - Unit pressure, Temperature rise, Length to diameter ratio, Radial clearance, Minimum oil-film thickness, oil whip and whirl, anti –friction bearing, hydrodynamic thrust bearing.

UNIT 6: HYDROSTATIC LUBRICATION **(06 Hrs)**

Principle of hydrostatic lubrication, General requirements of bearing materials, types of bearing materials., Hydrostatic step bearing, application to pivoted pad thrust bearing and other applications, Hydrostatic lifts, hydrostatic squeeze films and its application to journal bearing, optimum design of hydrostatic step bearing.

Section A: Unit 1, 2 and 3

Section B: Unit 4, 5 and 6

Reference Books:

1. Basu S.k., Sengupta S. N., Ahuja B.B. "Fundamentals of Tribology" PHI Ltd.
2. Friction Wear Lubrications Tribology Handbook Vol.1 Kragelsky I.V. Affiliated East-West Press.
3. B. C. Majumdar "Introduction to Tribology and Bearings", H. Whecier and Company Pvt. Ltd.
4. Cameron A. "Basic Lubrication Theory", Wiley Eastern Ltd.
5. D. F. Dudley, " Theory and Practice of Lubrication for Engineers", John Willey and Sons.
6. J. Halling, "Principles of Tribology", McMillan Press Limited.

Pattern of Question Paper

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For 80 marks Paper:

1. Five questions in each Section

2. Question no. 1 and 6 are compulsory for 10 marks each which contains short answer questions of 02 marks each.
03. From remaining four questions, attempt any two questions from each section.

LAB-V MED471- AUTOMOBILE ENGINEERING

Teaching Scheme

Practical: 2 Hrs/Week

Credit: 1

Examination Scheme

Term Work: 25 Marks

Practical Exam: 25 Marks

Practical:

Conduct at least 8 practical's demonstration and study on the actual component models from the following. Term work shall consist of record book on the experiments studies.
1. Layout of the automobiles, front, rear engine, 2W and 4W drives.

2. Study of conventional Petrol & Diesel Engine and MPFI and CRDI systems.

3. Study of Automobileclutches (single plate, multiple plate and centrifugal)

4. Study of Automobile Gear box (Sliding mesh, constant Mesh and Synchromesh)

5. Study of Automobile differential

6. Study Automobile Suspension Systems

7. Study Automobile steering System

8. Study of Automobile braking systems.

9. Study of Automobile Electric systems (starting, ignition and chargingsystem)

10. Study of air conditioning system in a car.

The assessment of term work shall be on the following criteria:

- **Continuous Assessment of the assignment based on the syllabus**

• Performing the experiments in the laboratory i.e. demonstration and working of the different components as mentioned above, also assembling and dissembling the parts for knowing the details. Practical Examination The practical examination shall be consisting of Viva- Voce based on the practical work done during the course and on the syllabus.

LAB-VI MED472- PROJECT MANAGEMENT AND OPERATION RESEARCH

Teaching Scheme

Practical: 2 Hrs/Week

Credit: 1

Examination Scheme

Term Work: 25 Marks

Practical Exam: 25 Marks

Practical:

At least 08 assignments from the following list should be studied during the course and record for the same should be submitted:

1. Assignment based on Introduction to Operations Research.
2. Assignment based on at least five numerical from Linear Models.
3. Assignment based on at least five numerical from Transportation Problems.
4. Assignment based on at least five numericals from Assignment Problems.
5. Assignment based on at least five numericals from Replacement Models.
6. Assignment based on at least five numericals from Queuing theory.
7. Assignment based on at least five numericals from Sequencing Models.
8. Assignment based on at least five numericals from Game Theory.
9. Assignment based on at least five numericals from Inventory Models.
10. Assignment based on at least five numericals from Network Models.

Term work:

The term work will consist of submitting a file for all the assignments with neatly written records. The term work will be assessed by the subject teacher.

Practical Examination:

- The Practical Examination will comprise of write-up of assignments and viva voce on the Syllabus.
- The practical examination will be assessed by two examiners, one will be the subject teacher and other examiner appointed by Dr. B.A.M.U. Aurangabad.

LAB VIII MED473- REFRIGERATION AND AIR CONDITIONING

Teaching Scheme	**Examination Scheme**
Practical: 2 Hrs/Week	**Term Work**: 25 Marks
Credit: 1	**Practical Exam:** 25 Marks

Performing minimum five experiments out of the following and preparing record of the experiments.

Practical:

1. Study of Various Tools used in Refrigeration Air Conditioning practice.
2. Study of Domestic Refrigerator.
3. Study of Different types of Air-Conditioning systems.
4. Study of Controls used in Refrigeration & Air conditioning such as expansion devices. Thermostat, HP, LP cut out, OHP, Relays, Solenoid valves. Humidity measurement.
5. Study of Leak detection & procedure for charging of Refrigerant.
6. Trials on following test rigs (any three)

a) Refrigeration test rig.
b) Air-conditioning test rig.
c) Heat pump.
d) Cascade refrigeration system.
e) Ice plant test rig.
f) Water Cooler Test rig.
g) Vapour absorption Test Rig
h) Window air conditioning Test Rig.

7. Technical reports on visits to refrigeration and air-conditioning establishments. (Any two).

Term work:

The term work shall consist of Performing / Studying five experiments from above mentioned experiments.

Practical Examination: The practical examination shall be consisting of Viva- Voce based on the practical workdone during the course and on the syllabus.

LAB-VIII -MED474-FINITE ELEMENT ANALYSIS

Teaching Scheme

Practical: 2 Hrs/Week

Credit: 1

Examination Scheme

Term work: 50 Marks

Term work:

The teamwork shall consist of record of any three from 1to4* and any three from 5 to 8** assignments of the problems based on following topics-

1. Computer program for stress analysis 2-D truss subjected to plane forces

2. Computer program for modal analysis 1-D beam (simply supported or cantilever beams)

3. Computer program for frames subjected to transverse forces and moments

4. Computer program for 1-D temperature analysis

5. Static stress concentration factor calculation for a plate with center hole subjected to axial loading in tension using FEA software.

6. 2D Forced convection problem using FEA software.

7. Modal analysis of any machine component using FEA software.

8. Stress and deflection analysis of any machine component consisting of 3-D elements using FEA software.

*1 Students can write the program in any of the programming language such as FORTRAN, C,

C++, MATLAB, Python, VB.

2. Minimum number of elements considered should be 10 or more.

3. Validate results of the program with analytical method or FEA software such as Abaqus, ANSYS, Msc-Nastran, Optistruct/Radioss, Comsol-Multiphysics.

** 1. Students should do convergence study for all assignment problems.

2. Use different element types from element library

3. If possible use submodel /symmetry option.

LAB-VIII -MED474- AEROSPACE ENGINEERING

Teaching Scheme

Practical: 2 Hrs/Week

Credit: 1

Examination Scheme

Term work: 50 Marks

Term work: Term work shall consist of Six assignments based on the syllabus which shall include the following:

1. Assignment based on unit-I

2. Assignment based on unit-II

3. Assignment based on unit-III

4. Assignment based on unit-IV

5. Assignment based on unit-V

6. Assignment based on unit-VI

LAB-VIII -MED474- INDUSTRIAL ENGINEERING

Teaching Scheme

Practical: 2 Hrs/Week

Credit: 1

Examination Scheme

Term work: 50 Marks

Term work:

Term work shall consist of eight assignments based on the syllabus which shall include the following:

1. Case study/numericals on productivity.
2. Prepare operation process chart (OPC) for given assembly.
3. Prepare flow process chart and flow diagram for given task.
4. Prepare man and machine chart/SIMO chart for given situation.
5. Calculate co-efficient of co-relation for time study person using performance rating technique.
6. Calculate standard time for a given job using decimal minute stop watch techniques.
7. Case study on Kaizen
8. Demonstrate the difference between maximum and minimum working area by assembly of 4-5 components.

The assessment of term work shall be on the following criteria:

- Continuous assessment

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Aurangabad

• Performing the experiments in the laboratory

LAB-VIII -MED474-COMPUTATIONAL FLUID DYNAMICS

Teaching Scheme

Practical: 2 Hrs/Week

Credit: 1

Examination Scheme

Term work: 50 Marks

Term Work: Term work shall consist of at least 08 Assignments/ Practicals from the list given below:

1. Assignment based on Unit-I consisting of any four numerical.

2. Assignment based on Unit-II.

3. Assignment based on Unit-III.

4. Assignment based on Unit-IV consisting of any four numerical.

5. Assignment based on Unit-V.

6. Assignment based on Unit-VI.

7. Study analysis of CFD softwares.

8. Study of various mesh generation schemes.

9. Analysis of Internal Flow by using any CFD software.

10. Analysis of External Flow by using any CFD software.

The assessment of term work shall be on the following criteria:

• Continuous assessment

• Performing the experiments in the laboratory

MED474- LAB-ELECTIVE-III: TRIBOLOGY

Teaching Scheme

Practical: 2 Hrs/Week
Credit: 1

Examination Scheme

Term work: 50 Marks

Term work:

Assignments Problems on -

1. Problem in hydrodynamic bearing
2. Reynolds equation
3. Derivation of squeeze film lubrication on rectangular plate and

Practical on (Any FOUR)

1. Journal bearing apparatus.
2. Tilting pad thrust bearing apparatus
3. Friction in journal bearing
4. Break line friction test rig.
5. Coefficient of friction using pin on disc test rig.

Term work:

The term work shall consist of Performing / Studying above mentioned experiments. The candidate shall submit the report of each experiment and the assignments.

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MED 475-PROJECT - II

Teaching Scheme

Practical: 4 Hrs/Week

Credit: 4

Examination Scheme

Term Work: 50 Marks

Practical Exam: 100 Marks

1. Student/s shall have to continue with the projects approved in last semester.

2. It is recommended to follow schedule of activities planned and accordingly have to work for completion of project under the guidance of allotted teacher.

3. Regular monitoring and guidance are expected to complete project in specified duration.

4. Student/s will have to prepare report of project similar to the seminar report with hard binding and golden embossing. Report shall consist of at least contents as that of seminar report.

5. Pre-demonstration session shall be arranged at the term end, in order to observe completion of project, corrections, proofreading of report shall be done by guide and committee. Suggestions are to be given for minor improvements in the project/project report. (If any)

6. Projects / Project report must be ready in all respect at the time of final dissertation.Term work marks will be allotted based on pre-demonstration performance, presentation and percentage of theme achieved.

Practical examination shall be based on final demonstration / presentation. Performance and percentage of theme achieved.

Note: Additional weight age shall be given to the projects participated in State / National / International competition.

Instructions:

1. The project report shall be typed on A-4 size white bond paper.

2. Typing shall be with spacing of 1.5 or 2.0 using black ribbon or carbon on one side of the paper.

3. Margins: (i) Left 37.5 mm. (ii) Right, top and bottom 25 mm.

4. Binding: Hard with golden embossing on the front cover of blue colour or soft comb binding with transp8.rent front cover and non transparent plastic blue/black cover.

5. From: cover in case of hard bound report: It should be identical to first title page.

6. Format for title page (First Page)

Report of the project

on

(TITLE OF PROJECT)

by

(Name of student)

Submitted in partial fulfillment of the requirements for the degree of

Bachelor of

Engineering (Mechanical)

Department of Mechanical Engineering

(NAME OF THE COLLEGE)

7. Format for Certification page (i.e. Second page)

CERTIFICATE

This is to certify that the project entitled

"Title of Project"

Submitted by

(Name of Student/s)

is completed as per the requirements of the Dr. Babasaheb Ambedkar

Marathwada

University in partial fulfillment of degree of

B.E.(Mechanical)

For the academic year--------

Guide	**Head of Department**	**Principal**
(Name & Sign)	(Name & Sign)	(Name & Sign)

8. The third page would be for acknowledgements which would be followed by index page.

9. Sketches should be drawn on separate sheet (minimum A4 size) and be inserted at proper places. The sketches should be drawn in black ink and be numbered.

10. Tables should preferably typed in the text only.

11. The mathematical symbol should be typed or neatly written so as to match darkness of the text.

12. The last item on the index should be references.

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International Centre of Excellence In Engg. & MGMT. ★ Aurangabad ★

CAMPUS DIRECTOR
International Centre of
Excellence In Engg. & MGMT.
Aurangabad