GOVERNMENT COLLEGE OF ENGINEERING, JALGAON.

Department of (Mechanical Engineering).

Scheme for B. Tech. (Mechanical Engineering)

SEM VII

Course Code	Name of the Course	Group	Teaching Scheme Hrs/week				Evaluation Scheme							Credits
							Theory				Practical		Total	
			TH	TUT	PR	Total	ISA	ISE1	ISE 2	ESE	ICA	ESE		
ME401	Refrigeration and Air Conditioning	D	3	--		3	10	15	15	60	---	---	100	3
ME402	Elective -I	C	3	---		3	10	15	15	60	---	---	100	3
ME403	Inter-disciplinary Elective	E	3	---		3	10	15	15	60	---	---	100	3
ME404	CAD/CAM	E	3	---		3	10	15	15	60	---	---	100	3
ME405	Programming in C ++	D	1		2	3	--	--	--	--	50	---	50	2
ME406	Refrigeration and Air Conditioning Lab	D	---	---	2	2	---	---	---	---	25	25	50	1
ME407	Elective -I Lab	D	---	---	2	2	---	---	---	---	25	25	50	1
ME408	CAD/CAM Lab	E	---	---	2	2	---	---	---	---	25	25	50	1
ME409	Project Phase-I	D	---	---	2	2	---	---	---	---	50	50	100	2
ME410	Seminar	D	---	---	2	2	---	---	---	---	50	--	50	2
ME411	Self Study - III	D	---	---	---	---	---	---	---	---	--	---	50**	2
		Total	**13**	**--**	**12**	**25**	**40**	**60**	**60**	**240**	**225**	**125**	**800**	**23**

TH: Theory Lecture, TUT: Tutorial, PR: Practical

ISA :Internal Sessional Assessment ISE : In Semester Examination ESE: End Semester Examination ICA : Internal Continuous Assessment

Interdisciplinary Elective

A Operations Research

B Renewable Energy Sources

C Introduction to Robotics

D Materials Management and Cost Estimation

Elective I

A Automobile Engineering - I

B Mechatronic System

C Tool Engineering

D Design of Thermal Equipment and Steam Turbine

- ****Marks and hence grade of course Self Study shall be based on one test each conducted on 20% syllabus of four subjects – ME401, ME402,**
- **ME403, ME404. One faculty member should be appointed as course coordinator for the course 'self study' to compile the marks of all tests and enter in to MIS.**
- **The 20% syllabus for self - study shall be declared by subject teacher at the beginning of semester and he/she shall conduct the test examination for that course, assess answer papers of test examination and submit the marks to course coordinator.**

ME 401 REFRIGERATION AND AIR CONDITIONING

Teaching Scheme: 03L+02P, **Total**: 05 **Credit:** 03
Evaluation Scheme: 15 ISE1 + 15 ISE2 + 10 ISA + 60 ESE **Total Marks:** 100
Duration of ESE: 03 hours

COURSE DESCRIPTION :

This course introduces undergraduate students to refrigeration and air conditioning. The background required includes a sound knowledge of Mathematics (Calculus), Engineering Thermodynamics, Applied Thermodynamics and Fluid Mechanics of second year Level. The course aims at imparting knowledge of refrigeration processes and air conditioning system.

DESIRABLE AWARENESS/SKILLS:

Fundamental knowledge of Physics and Engineering Thermodynamics.

PREREQUISITE:

Basic Thermodynamics- Laws of thermodynamics, Ideal gas processes, Thermodynamic cycles, Properties of pure substance, Mollier Charts, Fluid properties, Fluid dynamics, Modes of heat transfer, Governing Equations in Heat Transfer, Extended Surfaces, Condensation and Boiling, Heat Exchangers etc.

COURSE OBJECTIVES:

The Student should able to:

1. Learning the fundamental principles and different methods of refrigeration and air conditioning.
2. Study of various refrigeration cycles and systems for evaluating their performance .
3. Present the properties, applications and environmental issues of different refrigerants.
4. Operate and analyze the refrigeration and air conditioning systems.

COURSE OUTCOMES:

On successful completion of this course student shall be able to:

1. Understand the fundamental methods of refrigeration and air conditioning.
2. Analyze various refrigeration and air conditioning system .
3. Evaluate impact of refrigerants and refrigeration and air conditioning system environmental issues.
4. Apply the basic knowledge for designing the different refrigeration and air conditioning system

RELEVANCE OF COS /POS AND STRENGTH OF CO-RELATION:

PO/CO	CO-1	CO-2	CO-3	CO-4
PO-a	2			
PO-c			2	
PO-g		2		
PO-j				2

1-Weakly correlated 2 – Moderately correlated 3 – Strongly correlated

COURSE CONTENTS

Fundamentals and Applications of Refrigeration and Air Conditioning Fundamentals Reverse Carnot cycle, block diagram of refrigerator & heat pump (numerical), modified reverse Carnot cycle (Bell Coleman cycle) Applications Domestic Refrigerator, Domestic Air Conditioners, Automotive Air Conditioners, Evaporative coolers, water coolers, Commercial Refrigeration- Dairy, Cold storage, Ice plant, Commercial Air Conditioning Multiplex, Hospitals

.

Refrigerants and Vapour Compression Cycle

Refrigerants Classification of refrigerants, Desirable properties of refrigerants, environmental issues, Ozone depletion and global warming, ODP, GWP & LCCP, selection of environment friendly refrigerants, secondary refrigerants, anti-freeze solutions, Zeotropes and Azeotropes, refrigerant: recovery reclaims, recycle and recharge. Vapour Compression Cycle Working of simple vapour compression system, representation of vapour compression cycle (VCC) on T-s and P-h diagram, COP, EER, SEER, IPLV, NPLV, effect of operating parameters on performance of VCC, actual VCC, methods of improving COP using flash chamber, sub-cooling, liquid vapour heat exchanger, comparison of VCC with Reverse Carnot cycle,.

Refrigeration Systems

Vapour compression systems Single stage, two stage and cascade VCC systems using single and multi-evaporators Vapour absorption systems Introduction, Working of simple vapour absorption system (VAS), desirable properties of binary mixture (aqua-ammonia), performance evaluation of simple VAS (simple numerical treatment), actual VAS, Li-Br absorption system, three fluid system (Electrolux refrigeration), applications of VAS, comparison between VCC and VAC.

Psychometric and Air conditioning

Introduction to air conditioning, psychometric, psychometric properties and terms, psychometric relations, Psychometric processes and its representation on psychometric chart, BPF of coil, ADP, adiabatic mixing of two air streams, SHF, RSHF, GSHF, ESHF. Thermodynamics of human body, comfort and comfort chart, factors affecting human comfort, concept of infiltration and ventilation, indoor air quality requirements, factors contributing to cooling load.

Air Conditioning Systems

Working of summer, winter and all year round AC systems, all air system, all water system, air water system, variable refrigerant flow and variable air volume systems, unitary and central air conditioning. Components of refrigeration and air conditioning systems Working of reciprocating, screw and scroll compressors, working of air cooled, water cooled and evaporative condensers, Working of DX, Flooded, Forced feed evaporators, Expansion devices – Capillary tube, TXV, EXV, operating and safety controls.

Air Distribution Systems

Air handling unit, Classification of ducts, duct material, pressure in ducts, flow through duct, pressure losses in duct (friction losses, dynamic losses), air flow through simple duct system, equivalent diameter, methods of duct system design: equal friction, velocity reduction, static regain method (numerical on duct system design) Fan coil unit, types of fans used in air conditioning applications, fan laws, filters, supply and return grills, sensors (humidity, temperature, smoke).

Text Books:

1. Arora C. P., “Refrigeration and Air Conditioning”, Tata McGraw-Hill,2003
2. Manohar Prasad, “Refrigeration and Air Conditioning”, Willey Eastern Ltd, 1983
3. Arora and Domkundwar, “Refrigeration & Air Conditioning”, Dhanpatrai & Company, New Delhi,2008

4. Khurmi R.S. and Gupta J.K., “Refrigeration and Air conditioning”, Eurasia Publishing House Pvt. Ltd, New Delhi,2012
5. Ballaney P.L., “Refrigeration and Air conditioning”, Khanna Publishers, New Delhi, 1992

Reference books:

1. Dossat Ray J, “Principles of refrigeration”, S.I. version, Willey Eastern Ltd, 2000
2. Stockers W.F and Jones J.W., “Refrigeration and Air conditioning”, McGraw Hill International editions 1982.
3. Threlkeld J.L, “Thermal Environmental Engineering”, Prentice Hall Inc., New Delhi,2000
4. Aanatnarayan, “Basics of refrigeration and Air Conditioning”, Tata McGraw Hill Publication,2005
5. ASHRAE & ISHRAE handbook

ME 402 (A) Elective-I
AUMOBILE ENIGINEERING-I

Teaching Scheme: 03L+02P, **Total**: 05**,** **Credit:** 03
Evaluation Scheme: 15 ISE1 + 15 ISE2 + 10 ISA + 60 ESE **Total Marks:** 100
Duration of ESE: 03 Hrs

COURSE DESCRIPTION:

The purpose of this course is to impart adequate knowledge in both practically and theoretically, covering the various types of power-driven vehicles and to familiarize the students with the fundamentals of Automotive Engine System, Chassis and suspension system, steering system, wheels, tyres and tubes. The students are acquainted with the operation, maintenance and repairs of all the above systems of an automobile.

DESIRABLE AWARENESS/SKILLS:

Fundamental knowledge of Engineering Graphics, Machine Drawing, Mathematics, Physics, Metallurgy, Strength of materials, Theory of machines, Hydraulics and I.C. Engines

COURSE OBJECTIVE:

The Student should able to:

1. Introduction to engineering analysis of the automobile and its sub-systems
2. Application of engineering principles to automotive design
3. Familiarization with modelling and analysis methods
4. Familiarization with the automotive and its terminology

COURSE OUTCOMES:

On completion of this course; student shall be able to:

1. Develop a rudimentary understanding of various the automobile components, chassis frame and body
2. Understand power train function and the translation of torques and speeds throughout
3. Knowledge of various suspension types
4. Describe the functioning of front axle and steering system
5. Understand functions of wheel ,tire and tube, suspension and steering system properties.

RELEVANCE OF COS / POS AND STRENGTH OF CO- RELATION:

PO/CO	CO-1	CO-2	CO-3	CO-4	CO-5
PO-a	3	3	3	2	2
PO-b	3	3	2	2	2
PO-c	3	3	3	3	1
PO-d	3	3	3	3	1
PO-e	3	3	2	2	2
PO-f	3	3	3	3	3
PO-g	3	3	2	3	1
PO-h	3	3	3	2	2

1-Weakly correlated 2 – Moderately correlated 3 – Strongly correlated

COURSE CONTENTS:

Introduction to automobile

Definition, components of an automobile, the basic structure, the transmission system and its layout, engine location and drive arrangements, the auxiliaries, general classification of automobiles, classification of vehicles in India, Introduction to chassis, classification of chassis, materials used for chassis, frame: function, loads, construction, sub frame, defects in frame, frameless construction, vehicle dimensions, auto body styles, requirements of automobile body, components of a car body.

Drive Train

Definition, requirements of clutch, types, principle, Dry friction clutches: cone, single plate, diaphragm type single plate, multiplate, centrifugal, wet clutch, clutch components, clutch facing requirements, friction materials, facing materials, preliminary inspection, clutch adjustment, overhaul, trouble shooting, fluid flywheel, Transmission: Functions, necessity, types, sliding mesh type gear box, constant mesh gear box, synchromesh gear box, lubrication of gear box, gear box trouble shooting, epicyclic gear box, torque convertor, automatic transmission, continuous variable transmission, over drive, propeller shaft, universal joints, constant velocity joints, propeller shaft overhaul, propeller shaft trouble shooting, final drive, differential, rear axle, rear axle drives, rear axle trouble shooting.

Suspension systems

Introduction, objectives, basic considerations, functions, type of suspension springs: steel, rubber, plastic, air, hydraulic, torsion bar, shock absorbers, rigid axle and independent suspension, Front wheel independent suspension types: Wishbone, Mac Pherson strut, Vertical guide, Trailing link, Swinging half, Rear wheel independent suspension types: de Dion , trailing link type, semi-trailing link, stabilizer or anti-roll bar, air suspension, hydrolastic suspension, hydra gas inter-connected suspension, suspension system trouble shooting.

Front axle and steering

Introduction, front axle, wheel alignment, factors of wheel alignment, factors pertaining to wheels, steering geometry, correct steering angle, steering mechanism, cornering force, self-righting torque, understeer and oversteer, torque steering, vehicle handling, steering linkages, steering gears, steering ratio, reversibility, special steering columns, power steering, steering adjustment, checking wheel alignment and steering geometry, steering trouble shooting.

Wheels and tyres

Requirements of an automobile wheel, types of wheels, wheel dimensions, wheel alignment and balancing, tyre: desirable properties, types, carcass types, materials, consideration in tread design, section, designations, nitrogen in tyres, wider and narrower tyres, effect of air pressure and temperature on tyre, factors affecting tyre life, tyre retreading, precautions regarding the tyres, wheel and tyre trouble shooting

Text books:

1. Automotive Mechanics Principles and Practices, Joseph Heitner, 2nd Edition, 2013, Affiliated East-West Press Pvt Ltd.
2. Automobile Mechanics, N. K. Giri, 1 st Edition, 2004, Khanna Publishers
3. Automobile Engineering, G. B. S Narang, 3 rd Edition, 2012, S. Chand and Company Ltd.
4. Automobile Engineering -Volume 1, Dr. Kirpal Singh, 13th Edition, 2013, Standard Publishers and Distributors
5. Automotive Engineering Fundamentals, Richard Stone, Jeffrey K. Ball, 2004, SAE International

Reference books:

1. Motor Vehicle, K. Newton and W. Seeds, T.K. Garrett, 13th Edition, 2001, Elsevier publications
2. Handbook of Automotive Engineering, Hans Hermann Braess, Ulrich Seiffen, 1 st Edition, 2005, SAE Publications
3. Automotive Mechanics, William H. Crouse, 10th Edition, 2006, Tata McGraw Hill Publishing House

ME 402 (B) Elective-I
MECHATRONICS SYSTEM

Teaching Scheme: 03L+2P**, Total:** 05 **Credit:** 03
Evaluation Scheme: 15 ISE1 + 15 ISE2 + 10 ISA + 60 ESE **Total Marks:** 100
Duration of ESE: 03 hours

COURSE DESCRIPTION:

This course introduces to graduate students the basic mechatronics system components, and the design principles of using mechatronics to meet functionality requirements of products, processes and systems.

DESIRABLE AWARENESS/SKILLS:

Knowledge of Mechanical, Electronic, Instrumentation and measurement systems.

COURSE OBJECTIVE:

The Student should able to:

1. acquire the knowledge of basics of mechatronics and their scope.
2. acquire the knowledge of sensors and transducers.
3. Understand fundamental of hydraulic and electrical actuators.
4. acquire the knowledge of data acquisition system and control system.
5. develop the ability to analyze and design mechatronics system.

COURSE OUTCOMES:

On successful completion of this course student shall be able to:

1. Apply knowledge of mechatronics for understanding and solving engineering problems.
2. Acquire knowledge and hands-on competence in applying the concepts of mechatronics in the design and development of mechanical systems.
3. Demonstrate creativeness in designing new systems components and processes in the field of engineering in general and mechanical engineering in particular.
4. Identify, analyze and solve mechanical engineering problems useful to the Industry.
5. Work effectively with engineering and science teams as well as with multidisciplinary designs.

RELEVANCE OF COS / POS AND STRENGTH OF CO RELATION:

PO/CO	CO-1	CO-2	CO-3	CO-4	CO-5
PO-a	2	1	1	1	3
PO-b	3	2	1	1	1
PO-j	1	2	1	3	1
PO-l	1	1	3	2	1
PO-g	1	3	1	1	2

1-Weakly correlated 2–Moderately correlated 3–Strongly correlated

COURSE CONTENT:

Introduction to Mechatronic systems elements, advantages and practical examples of mechatronic systems. Sensors and Transducers: Various types of sensors and transducers used in mechatronic system such as pressure sensors, temperature sensors, velocity sensors, acceleration sensors, proximity sensors, position sensors, force sensors, Optical encoders, Capacitive level sensor, tactile sensors, Selection of sensors.

Signal Conditioning and Data Representation: Types of electronic signals, Need for signal processing, Operational amplifiers: Types, classification and applications, Opto-isolators, Protection devices, Analogue to Digital and Digital to Analog Converters, Interfacing devices, Electro-magnetic Relays, Data representation systems, Displays, Seven segment displays, LCD displays, Printers, Data loggers, Data Acquisition Cards/Systems

Drives and Actuators: Electrical Drives: Types of Electrical Motors, AC and DC motors, DC servomotors, Stepper motors, linear motors, etc. Pneumatics and Hydraulics: Components of Pneumatic systems, actuators, direction control valves, pneumatic air preparation, FRL unit, methods of actuation of valves, Electro-pneumatic valves, Electro-pneumatic circuits using single and double solenoid methods.

Microprocessor and Microcontroller:8085 microprocessor, architecture, various types of registers and their functions in 8085μP, Instruction sets, interfacing, applications.8081 microcontroller, architecture, Instruction sets, various pins and their functions interfacing, applications. Programmable Logic Controller: Introduction, Architecture, Types of inputs/outputs, Specifications, guidelines for selection of PLCs, Programming: Ladder logic and FBD

Control Systems: Open and closed loop system; block diagram manipulation/reduction, Transfer function, Modeling of Mechanical Systems using Spring, Dashpot and Mass equivalence. Stability of Systems: On/Off controller, Proportional Control, Integral control, Derivative Control; PI, PD and PID Controllers.

Text Books

1. A Text Book of "Mechatronics: A multi-disciplinary approach" by W Bolton, Fourth edition, Pearson education,2008
2. A Text Book of "Mechatronics" by HMT Ltd, Indian edition, Tata McGraw-Hill, New Delhi, reprint 2014
3. A Text Book of "Mechatronics: Principles, Concepts and Applications" by N.P.Mahalik, First edition, Tata McGraw-Hill Education, 2003
4. A Text Book of "Mechatronics" by R.K.Rajput, Third edition, S. Chand Limited, 2007

Reference Books

1. "Mechatronics" by M. D. SINGH, J. G. JOSHI Published by PHI Learning, 2009
2. "Mechatronics Sourcebook" by N. C. Braga, First edition, Delmar Learning, 2002
3. "Mechatronics System Design" by Shetty D, Kolk Ra, second edition, PWS Publications, Boston, 2010

ME 402 (C) Elective-I
TOOL ENGINEERING

Teaching Scheme: 03L+2P**, Total** : 05 **Credit:** 03
Evaluation Scheme: 15 ISE1 +15 ISE2 + 10 ISA + 60 ESE **Total Marks:** 100
Duration of ESE: 03Hrs

COURSE DESCRIPTION:
This course provides the basic knowledge of Tool Engineering. Course includes information of cutting tools,Economics of toolings, Design of jigs and fixtures, Sheet metal working and Limit guages.

DESIRABLE AWARENESS/SKILLS:
Fundamental knowledge of Engineering Graphics, CAD , Metrology and Quality Control and Advanced machining processes.

COURSE OBJECTIVE:
The Student should able to:

1. understand terminology and Tools Engineering.
2. understand all cutting tools.
3. understand economics of tooling.
4. understand the Advanced knowledge of Jigs, fixtures and Press tools.
5. understand principles of limit gauges.

COURSE OUTCOMES:
On successful completion of this course student shall be able to:

1. Design of Circular and flat form tool.
2. Mathematical analysis of equipment and tooling cost.
3. Design the complicated jigs and fixtures .
4. Design of press tool using CAD.
5. Design of GO and NOGO limit gauges.

RELEVANCE OF COS / POS AND STRENGTH OF CO- RELATION:

PO/CO	CO-1	CO-2	CO-3	CO-4	CO-5
PO-c	1	2	2	2	2
PO-f	3	1	3	3	3
PO-g	3	3	3	3	3
PO-l	2	2	3	3	3
PO-m	2	1	2	3	2

COURSE CONTENT:

Cutting tools

Cutting tool standards and materials Tool signature ORS & ASA methods, tool standards: Single point cutting tool, drills, broach, reamer, milling cutters.. Cutting tool materials, heat treatment of tools. Study of modern tool materials such as uncoated / coated carbides, Ceramics, cermets, cubic boron nitride, diamond etc., Advance tool materials, coating on tool, throwaway inserts. Desirable properties of tool material, Selection of tool grades and styles including specifications from commercial catalogues for different processes like turning, milling, drilling, grinding for different operations.

Design of Tool:

Design of flat form tool and circular form tool. Geometry, nomenclature, types, selection and applications of drills, reamers, milling cutters and broach. Design of cutting tools Single point cutting tool, Form tool: design of circular & flat form tools.

Economics of Tooling

Problems encountered in the economics of tooling, fixed and variable cost, Depreciation and its types, Machine tool replacement, Return on investment, Mathematical analysis for equipment selection, economics of small tool selection, Small tool replacement, Break even point analysis, Economic lot size, Minimum cost analysis, Difference between economic batch quantity and break-even quantity.

Design of Jigs and fixtures

Design of Jigs and fixtures for complicated parts . Indexing, locking and auxiliary elements. Bodies and bases or frames of Jigs and fixtures. Boring fixtures, broaching fixtures grinding fixtures, welding fixture , Pneumatics & Hydraulics for jig & fixtures, Concept of Modular Fixtures, Economics of Jigs and fixtures.

Gauges and Gauge Design

Purpose, Classification of gauges, Design of Limit gauges, Manufacturing tolerances, Wear allowance, Taylor's principle, Thread and screw gauges. Other gauges.

Press Tool Design

Design of cutting die, bending and drawing die using CAD modelling and analysis.

Text Books :

1. P H Joshi, "Jigs and Fixture", Tata McGraw Hill, 2006.
2. P.C. Sharma, "A Text Book of Production Technology", S. Chand, 2007
3. Ostergaard, "Basic Die Making", MGH, New York, 1993.
4. P.H. Joshi, "Press Tool Design and Construction", Wheeler Publishing, Delhi, 2000.

Reference Books:

1. Kempster, "Introduction to Jigs & Tool Design", Viva Books Pvt. Ltd,1998.
2. Cyryll Donaldson, George H. Lecain, V.C. Goold, "Tool Design", Tata Mcgraw Hill, 2002
3. Joshi, "Machine Tools Handbook : Design and Operation", McGraw Hill, 2008 [R2] J.R.Paquin, Die Design Fundamental", Industrial Press, Inc. New York, NY, USA, 2005
4. Vukota Boljanovic,"Sheet Metal Stamping Dies: Die Design and Die-Making Practice", Industrial Press, Inc. New York, NY, USA
5. Oehler, "Hydrualic Presses", Arnold Press, 1968.
6. Ghosh and Mallik,"Manufacturing Science", East West Publications.

ME 402 (D) Elective-I
DESIGN OF THERMAL EQUIPMENT AND STEAM TURBINE

Teaching Scheme: 03L+02P, **Total**: 05 **Credit:** 03
Evaluation Scheme: 15 ISE1 + 15 ISE2 + 10 ISA + 60 ESE **Total Marks:** 100
Duration of ESE: 03Hrs

COURSE DESCRIPTION:

To understand the design of various heat transfer equipments and steam turbines.

COURSE OBJECTIVE:

The Student should able to:

1. Design and analyze the construction, working and performance different. Heat Transfer equipment
2. Design and analyze the construction, working and performance different steam turbines

COURSE OUTCOMES:

On completion of this course; student shall be able to:

1. Apply Knowledge of thermodynamics to design heat transfer equipments.
2. Analyze impulse and reaction turbo machines for energy transfer
3. Design of Boiler furnace water wall tubes, reheater and economizers.
4. Design of steam turbine and nozzles.

RELEVANCE OF COS /POS AND STRENGTH OF CO-RELATION:

PO\CO	CO-1	CO-2	CO-3	CO-4
PO - a	2	3	2	1
PO - b	1	2	3	2
PO - g	3	2	3	2
PO - h	2	2	3	2

1-Weakly correlated 2 – Moderately correlated 3 – Strongly correlated

COURSE CONTENTS:

Design of Heat Transfer Equipments

Design principle of heat transfer equipment, LMTD and NTU Methods, design of double pipe heat exchangers, Shell and tube heat exchangers, compact heat exchangers, steam condensers, feed water heaters, drain coolers. Design of Boiler furnace water wall tubes, reheater and economizers. Design of regenerative and recuperative air Preheaters.

Flow of steam through Impulse Turbine

Rankine cycle, regenerative and re-heating analysis

Single and multistage impulse turbine with single row wheels compounding velocity diagram, calculation of Work done and efficiency, ratio of blade speed, blade height in velocity compounded wheels.

Flow of steam through Impulse Reaction Turbine

Meaning of impulse reaction, degree of reaction, height of reaction reading, stage efficiency and parson's turbine.

Vortex Flow in steam turbine, experiment of turbine, blade, internal losses in steam turbine, state-point locus and reheat factor.

Turbine performance

Turbine performance at varying loads, , turbine blades, blade attachments, construction of turbine rotor, stress in turbine rotors, critical speed of turbine rotors, construction of cylinder, glands and packing devices, bearing and lubrication and governors , gears and output of steam turbines.

Flow of steam through nozzles

Construction of nozzles and diaphragms, design of steam nozzle.

Text Books:

1. W. Krays and A. C. London :compact heat exchangers McGraw Hill,1987
2. D. Q. Kem : Process heat transfer, McGrawHill,1987

Reference books

1. J. E. Lee Theory and design of steam and gas turbines.
2. Church, Steam turbines
3. W. J. Kerton- Steam turbine theory and practice, CBS Publisher 1998
4. S. Kokac, Heat exchanger- thermal hydraulic fundamentals and design, hemisphere McGraw Hill,1987
5. D. Q Kem and A. D. Kraus: Extended surface heat transfer McGraw Hill ,1987

ME 403 (A) Interdisciplinary Elective-I
OPERATION RESEARCH

Teaching Scheme: 03L**, Total:** 03 **Credit:** 03
Evaluation Scheme: 15 ISE1 +15 ISE2 + 10 ISA + 60 ESE **Total Marks:** 100
Duration of ESE: 03Hrs

COURSE DESCRIPTION:

This course introduces under graduate students to imparting knowledge of various decision making techniques.

COURSE OBJECTIVES:

The Student should able to:
1. Provide about Operational research and its model.
2. Develop knowledge about Linear programming.
3. Develop knowledge about transportation, assignment and Sequencing model.

COURSE OUTCOME:

On successful completion of this course student shall be able to:
1. Develop knowledge of Operational research and its model.
2. Helped to understand the Linear programming
3. Develop knowledge about transportation, assignment and Sequencing model.

RELEVANCE OF COS /POS AND STRENGTH OF CO-RELATION:

PO/CO	CO1	CO2	CO3
PO - c	3	2	1
PO - j	2	2	2
PO - m	2	2	3

1) Weak 2) Moderate 3) Strong

COURSE CONTENTS

Introductions to Operation Research

The history of OR, Definition, Features, of OR, models and modelling in OR, OR approach to problem solving, methods for solving OR models, phases of OR, Advantages of OR study, Shortcomings of OR approach, OR Models in Practice, Applications of OR.

Linear Programming-

Applications and model formulation, Introduction, general Stricture of LP model, Assumption of an LP model, Advantages and Limitations of Linear programming, Applications areas of LP, steps of LP Model formulation, Graphical solution methods of LP problem, maximization, minimization, feasible, infeasible and unbounded solution. The simplex method Introduction, standard form of an LP problem, simplex algorithm (maximization, minimisation case) Degeneracy in simplex problem, unbounded Infeasible solution. Duality in Linear programming, formulation of dual LPP, Advantages of duality, rules for constructing the Dual from primal.

Transportation Model

Transportation problem introduction, mathematical model of transportation problem, Algorithm, methods for finding initial solution northwest corner method ,Least cost method, Vogel's Approximation method, test for optimality steps of MODI method, maximization problem, unbalanced, degeneracy, prohibited transportation Routes problem.

Assignment Model and Game Theory

Introduction, mathematical models of assignment problem, solution method of assignment problem, Hungarian method, maximization case, unbalanced Restrictions on assignment, travelling salesman, problem. Introduction To Theory of games ,Two person Zero sum game, pure strategies, maxi-min, mini-max principles, game with saddle point, mixed strategy games, The principles of dominance ,games without saddle point, algebraic method, arithmetic method, sub game method, Graphical method.

Replacement and Sequencing Model

Replacement and maintenance method- Introduction, types of failure- gradual failure ,sudden failure Replacement of items whose efficiency deteriorates with time, Replacement of items that completely fail, individual replacement policy, Group replacement policy, staffing problem ,failure trees. Sequencing problem- Introduction notations, Terminology, and assumptions of sequencing problem, Processing n jobs through two machines, Processing n jobs through three machines, Processing n jobs through four machines, Processing n jobs through five machines.

Queuing Theory

Introduction to queuing theory, elements of queuing theory, characteristic of waiting lines, Service Discipline, Service Mechanism, Terminology and Notations for Queuing System.

Text Book

1. Optimization Concepts and Applications in engineering, Belegundu, Cambridge Uni. Press, India
2. Operations Research, Hillier F.S., and Lieberman G.J., Eight Edition, Mc. Tata McGraw Hill, India
3. Engineering optimization Methods and Appliations, Ravindran, 2nd edition, Wiley, India
4. Operations Research Principles and Practice, Ravindran, Phillips and Solberg, Second Edition, Mc. WSE Willey,
5. Operations Research - An introduction, Hamdy A Taha, Pearson Education.

Reference Books

1. Quantities Techniques, L.C. Jhamb , Vol I and II, Everest Publication
2. Operation Research, S.D. Sharma, Khanna Publication.
3. Operation Research, Problem and Solution, J. K. Sharma, Macmillan
4. Quantitative Techniques in Management, N. D. Vohra, TATA McGraw Hill.
5. Operation Research Principles and Practice, Ravindran, Wiley India Pvt. Ltd. New Delhi
5. An Introductory Approach to Operations Research, Robert J. Thierauf, A Wiley/Hamilton Publication
6. Problems in Operations Research: Principles and Solutions, Prem Kumar Gupta, D. S. Hira, S. Chand, 1991
8. Operations Research: Theory And Application, J. K. Sharma, Laxmi pub. India.
9. Operations Research, S. D. Sharma, Kedar Nath Ram Nath-Meerut.

ME 403 (B) Interdisciplinary Elective-I
RENEWABLE ENERGY SOURCES

Teaching Scheme: 03 L, Total: 03 **Credits:** 03
Evaluation Scheme: 15 ISE1 + 15 ISE2 + 10 ISA + 60 ESE **Total Marks:** 100
Duration of ESE: 03 Hrs

COURSE DESCRIPTION:

Renewable energy sources are interdisciplinary subject of science & technology. Energy technology is the back boon of modern civilization and national economy. It is an applied science dealing with various renewable energy routes comprising the exploration and extraction of energy and by products, transportation, storage, distribution and supply of secondary forms of energy. This course explores available renewable energy sources and provide the platform to study judicious and economic choice of energy for environment friendly and sustainable development.

DESIRABLE AWARENESS/SKILLS:

Knowledge of basic science, mathematics and subject of engineering.

COURSE OBJECTIVE:

The Student should able to:

1. Understand the various renewable energy sources
2. Understand their conversion technology and application.
3. Help to bring down gap between energy demand and energy generation with environment friendly.
4. Provide basic knowledge for lifelong learning and higher education in field of energy conversion.

COURSE OUTCOMES:

On completion of this course; student shall be able to:

1. Apply basic knowledge of science, mathematics & engineering for understanding energy sources and conversion in useful forms.
2. Understand facts, concepts, and principles of exploration and extraction of energy for judicious and economic choice of energy for environment friendly and sustainable development.
3. Function on interdisciplinary subject of science & technology and analyze the characteristics of different energy sources.
4. Understand the contemporary issues of energy and solve engineering problem of energy extraction from different renewable sources by modern tools.
5. Discharging duties in energy development by understanding an ethical and social responsibility for answerable to next generation.

RELEVANCE OF COS / POS AND STRENGTH OF CO- RELATION:

PO/CO	CO-1	CO-2	CO-3	CO-4	CO-5
PO-a	3	2	2	2	2
PO-c	2	3	1	3	2
PO-d	2	1	1	2	3
PO-g	2	2	3	3	1

1-Weakly correlated 2 – Moderately correlated 3 – Strongly correlated

COURSE CONTENT

Solar Photovoltaic

Introduction to energy technology and energy sciences, energy and environment, laws of conservation of energy. Introduction to solar photovoltaic system, Silicon Solar Cells, Photovoltaic Modules, Module efficiency, PV panels and arrays, Solar Photovoltaic Systems(SPS), Solar PV lighting systems, PV Lanterns, Solar water Pumping, PV Roof top technology, Life cycle cost estimates.

Geothermal Energy

Introduction to geothermal energy, geothermal energy resources, origin of geothermal resources, geothermal gradients, hydro geothermal resources, geo-pressured resources, geothermal fluid for electric power plants and classification and types of geothermal power plants.

Wind Energy

Introduction to wind energy, nature of wind energy conversion system, wind power density, forces on the blades of the propeller, wind turbine efficiency, wind velocity duration characteristic, type of wind turbine-generator unit, planning of wind farm and grid connection.

Biomass Energy

Introduction to biomass energy resources, biomass conversion process, direct combustion of biomass, gaseous fuels from biomass, introduction to urban solid waste to energy by incineration process and energy plant, location of plants, wood and wood waste as primary energy source and cogeneration plant.

Energy from the Oceans

Introduction, Ocean thermal electric conversation (OTEC), Claude & Anderson cycles, evaporators, Bio-fouling, Hybrid cycle, Introduction of energy from Tides, basic principles of Tidal power, components of Tidal Power Plants, operation methods of utilization of Tidal Energy, Advantages & limitations of Tidal Power Generations, Prospects of Tidal Energy in India.

Text Books:

1. Solar Energy, H P Garg, J Prakash, First Revised Edition, Reprint 2012, Tata McGraw Hill Education private Limited, New Delhi.
2. Non Conventional Energy Sources, G. D. Rai, Fourth Edition, 2008, Khanna Publishers, New Delhi.

References Books:

1. Solar Energy, S. P. Sukhatme, J. K. Nayak, Third Edition, 2008, Tata McGraw Hill Education private Limited, New Delhi.
2. Energy Technology – Non conventional, Renewable & Convetional, S. Rao, Dr. B. B. Parulekar, Third Edition, 2010, Khanna Publishers, New Delhi.
3. Understanding Clean Energy & Fuels from Biomass, Dr. H. S. Makunda, 2011, Wiley India.
4. http://nptel.iitm.ac.in

ME 403 (C) Interdisciplinary Elective-I
INRODUCTION TO ROBOTICS

Teaching Scheme: 03L**, Total:** 03 **Credit:** 03
Evaluation Scheme: 15 ISE1 +15 ISE2 + 10 ISA + 60 ESE **Total Marks:** 100
Duration of ESE: 03Hrs

COURSE DESCRIPTION

This course is aimed to provide exposure on the Robot anatomy, sensors, kinematics, End Effectors, Sensors And Vision Systems, applications and problems associated with their design.

COURSE OBJECTIVES:

The Student should able to:
1. Provide about robot drives and control system.
2 Develop knowledge about end effectors and sensors.
3. Develop knowledge about robot vision system and robot programming.

COURSE OUTCOME:

On the successful completion of this course; student shall be able to
1. Develop knowledge of robot drives and control system.
2. Helped to understand the end effectors and sensors.
3. Develop knowledge about robot vision system and robot programming.

RELEVANCE OF COS / POS AND STRENGTH OF CO- RELATION:

PO/CO	CO1	CO2	CO3
PO - a	3	2	1
PO - b	3	3	2
PO - j	1	1	3

1. Weak 2) Moderate 3) Strong

COURSE CONTENTS:

Basic Concept In Robotics

Historical perspective of robot, classification of robot, automation and robotics, robot anatomy, basic structure of robotics. resolution, accuracy and repeatability, classification and structure of robotics system, point to point and continuous path system, control loop of Robotic application Current and future.

Drives And Control System

Hydraulic, DC servomotors, basic control system, concept and models, control system analysis. Robot activation and feedback component, positional and velocity sensors. Actuators, power transmission system, Application of robot in manufacturing.

End Effectors and Sensors in Robotics

End Effectors Types of end effectors, mechanical grippers, vacuum, magnetic, adhesive grippers, tools as end effectors, Gripper selection and Introduction to Sensors: Need of sensors in a robotic system, selection of sensors, photo sensors, limit switches. Range sensors, proximity sensors, touch / sensors.

Robot Vision System

Concept of low level and high-level vision in a robotic system. Lagrange's Analysis of Manipulator and Components, functions of vision system, industrial application of vision controlled robotic system, advantage and application of machine vision.

Robot Programming

Methods of robot programming, lead through programming methods, a robot program as a path in space. Motion interpolation WAIT, SIGNAL, AND DELAY commands. ROBOT LANGUAGES: The textural robot languages, generation of robot programming languages, robot language structure, constant and variables.

Text Books

1. Robotic Engineering An Integrated Approach, Richard D. Klafter, Thomas A. Chmielewski and Michael Negin, Prentice Hall India, 2002.
2. Industrial Robotics,M. P. Groover, McGraw Hill Publication Co. Ltd.
3. Introduction to Robotics Mechanics and Control, John J. Craig, Pearson Education Inc.,

Reference Books

1. Industrial Robotics - Technology, Programming and Applications, M. P. Groover.
2. Introduction to Robotics: Analysis System and Application, Niku, Pearson Education
3. Advances in Robot Design and Intelligent Control**,** Rodić, Aleksandar, Borangiu**,** Theodor

ME 403 (D) Interdisciplinary Elective
MATERIALS MANAGEMENT AND COST ESTIMATION

Teaching Scheme: 03L**, Total:** 03 **Credit :** 03
Evaluation Scheme: 15 ISE1+15 ISE2+10 ISA+ 60ESE **Total marks :** 100
Duration of ESE: 03 Hrs.

COURSE DESCRIPTION :

This course introduces undergraduate students to different modes of planning the material sources, schedule of flow of material, management and governance of all material stocking.

DESIRABLE AWARENESS/SKILLS:

A sound knowledge of Industrial engineering, operations techniques, production planning & control techniques, work study and time study techniques are basic prerequisite

COURSE OBJECTIVES

Students should be able to:

1. understand the stocking of material
2. plan the production, and control
3. use development techniques for vendor developments
4. know the procurement procedure for materials, documentation,

COURSE OUTCOMES:

On completion of this course student should be able to:

1. identify source of materials , and costing
2. schedule & plan materials flow,
3. technically sorting material status in various stages under production for inventory control, apply various techniques to boost up capability of vendor, and able to use various techniques of developments.

RELEVANCE OF COS /POS AND STRENGTH OF CO-RELATION:

PO/CO	CO-1	CO-2	CO-3
PO-d	1	2	3
PO-e	2	1	2
PO-g	3	2	2
PO-i	3	3	1

1-Weakly correlated 2 – Moderately correlated 3 – Strongly correlated

COURSE CONTENTS

Introduction

Materials management – An overview– Scope Objective, Importance Integrated approach to Materials Management.

Materials Planning

Introduction – Factors affecting material planning – Techniques of material planning – MRP.

Vendor Management

Vendor selection, vendor auditing, vendor development and its importance, techniques of development, vendor suppliers prerequisites.

Purchase Management

Purchasing, Procedure & Pricing Issues , Enquiry letter, Quotations , Comparative statement , Purchase orders, Tendering – Scrutiny of indents, preparation of tender documents, Evaluation of tenders and Award of orders .Application of Computers in Purchasing, E-procurement guidelines.

Stores Management

Stores function, Types of stores, stores identification system, Receipts, Inspection , Storage procedure, Safety and Security aspects, Issue system, Disposal of unserviceable scrap including survey off and disposal activity, stock verification and store accounting, store records, legal aspects of store keeping.

Inventory Control Management

Inventories – Definition-Classification of Inventories- Need for inventories – Merits & Demerits of Inventories, Inventory control techniques and principles - classification, codification, standardization – ABC analysis –VED, GOLF, FSN – HML, Economic order quantity concept – Derivation of EOQ formula, modified EOQ.

Introduction to Cost Estimation

Importance of costing and estimation –methods of costing elements of cost estimation –
Types of estimates – Estimating procedure Estimation labour cost, material cost allocation
of over head charges Calculation of depreciation cost

Production Cost Estimation and Machining Time Calculation

Estimation of Different Types of Jobs Estimation of Forging Shop, Estimation of Welding Shop, Estimation of Foundry Shop, Estimation of Machining Time Importance of Machine Time Calculation of Machining Time for Different Lathe Operations, Drilling and Boring Machining Time Calculation for Milling, Shaping and Planning Machining Time Calculation for Grinding

Text Book:-

1. Materials and logistics Management – Prof. Shailesh Kasande, Nirali publication, pune
2. Materials and logistics Management – Dr. L. C. Jhamb, everest publishing house, new delhi

Reference book:-

1. Purchasing and Materials Management – Datta A. k , 5th edition PHI Publishing House,2005, India
2. An integrated approach to Materials Management – Gopalkrishnan & Sundersan PHI Publication 2002 .
3. Principles and practice of Management Prasad, L.M. 5th edition Sultan Chand & Sons, 2006.
4. Supply chain Management: Strategy, Planning and Operations Chopra, S., and Meindl, P.

Second Edition, Pearson Education (Singapore) Pte. Ltd, 2004.
5. Designing & Managing the Supply Chain: Concepts, Strategies & Case studies Simchi -Levi, D., Kaminsky, P., and Simchi-Levi, E.,. Second Edition, Tata McGraw-Hill Edition, 2003.
6. Purchsing and Supply Chain Management: Text and Cases, Doebler, D.W. and Burt, D.N., McGraw-Hill Publishing Company Limited, New Delhi, 1996.

ME 404- CAD/CAM

Teaching Scheme: 03L+02P**, Total:** 05 **Credit:** 03
Evaluation Scheme: 15 ISE1+15 ISE2+10 ISA+ 60ESE **Total marks:** 100
Duration of ESE: 03 Hrs.

COURSE DESCRIPTION:

The course presents the elements of solid modelling, creation of parts of increasing complexity and the assembly of parts to form a final design, along with mechanism simulation. The operation and programming of CNC machines is covered.

DESIRABLE AWARENESS/SKILLS:

Fundamental knowledge of Computers, Engg. Graphics, Graphical entities, Computer Networking, Manufacturing Processes, Industrial Engg.

COURSE OBJECTIVE:

Students should be able to:

1. Use of Computers in Design and Manufacturing
2. Interface of Computer Software and Hardware
3. Automation of Manufacturing System
4. Applications of Robotic systems in manufacturing

COURSE OUTCOMES:

On completion of this course student should be able to:

1. Students will demonstrate fundamental knowledge of CAD/CAM.
2. Students will be able to solve numerical on transformation and modelling of curves.
3. Students will be able to generate the tool path for parts.
4. Students will be able to write CNC program.
5. Students will know the terminology of various prototyping techniques.

RELEVANCE OF COS / POS AND STRENGTH OF CO- RELATION:

PO/CO	CO-1	CO-2	CO-3	CO-4	CO-5
PO-a	-	3	-	-	-
PO-h	3	-	-	-	-
PO-i	-	-	-	3	-
PO-j	-	-	-	2	-

1-Weakly correlated 2 – Moderately correlated 3 – Strongly correlated

COURSE CONTENT

Introduction to CAD/CAM and Networking

Definition of CAD/CAM, Product Life Cycle & CAD/CAM, Selection of a CAD system, Desirable relationship of CAD/CAM database, Benefits & Application of CAD. Hardware in CAD, The Design Work Station, The graphics terminal, Operator input/output devices, Computer communication, Principle of networking, Classification of network, Transmission media & interface, LAN system.

Computer Aided Graphics

Introduction, Graphic Primitives, Co-ordinate system used in graphic element.
2D transformation, Homogeneous transformation, Concatenate co-ordinate transformation, Translation, Rotation, Scaling, Mirror, Reflection, Inverse co-ordinate transformation, clipping.
3D transformation, View Port, Windowing, Standardization in graphics IGES files.

Computer Aided Modelling & Automation

Requirement of Geometric Modelling, Geometric Model, Geometric Model Construction Method: Wire Frame Modelling, Surface Modelling, Solid Modelling, Representation of Curve & Surfaces, Design of curve shape, Cubic Spline, Bezier curve, B-spline curve.
AUTOMATION- Concept of Automation, Types of Automation, Advantages & limitations of Automation, Levels of Automation, Advanced Automation Function.

Computer Aided Manufacturing

INDUSTRIAL CONTROL SYSTEM- Continuous control system, Discrete control system, Computer process control, Forms of CPC, Computer process Monitoring, Direct Digital Control, Numerical Control & Robotics, Programmable logic controller, Supervisory control, Distributed Control & Personnel Computers
CNC PROGRAMMING- Axis of CNC Machines, Manual Part Programming using G and M codes, Adoptable to Fanuc Controller for Lathe.

Introduction to FMS, GT and Robotics

FMS – Introduction, Components of FMS, Types of FMS, Application & Benefits, Planning & implementation issue, Typical FMS layout.
GT – Part families, Part classification & coding, optic coding system, Multiclass coding system, Application of GT, Robotics – Robot Anatomy, Robot Control System, Sensors, End effectors, Industrial Robot, Application and its selection.

Rapid Prototyping and Manufacturing

Introduction to Rapid Prototyping, rapid tooling and rapid manufacturing, Process of rapid prototyping, Different techniques of Rapid prototyping and their applications. Introduction to 3D printing and 3D Scanning, necessity, classification of 3D printing, various applications of 3D printing.

Text Book:-

1. Ibrahim Zeid and R. Sivasubramanian – "CAD/CAM– Theory and Practice", Tata McGraw Hill Publishing Co., 2009
2. Ibraim Zeid, "Mastering CAD/CAM" – Tata McGraw Hill Publishing Co., 2000
3. Rao P.N. - "Introduction to CAD/CAM", Tata McGraw Hill Publishing Co., 2012

References Books

1. Yoram Koren – "Robotics", McGraw Hill Publishing Co., 2007

2. P. Radhkrishnan, S. Subramanyam, V. Raju- “CAD/CAM/CIM”, New Age Publication, 2008
3. Zeid- “CAD/CAM”, T.M.H., 1991
4. B.S. Pabla, M. Adithan- “CNC Machine”, New Age International (P) Ltd., 2014.

ME 405 PROGRAMMING IN C++

Teaching Scheme: 01L+02P, **Total:** 03 **Credit:** 02

Evaluation Scheme: 50 ICA **Total Marks:** 50

–

COURSE DESCRIPTION:

This course provides students with a comprehensive study of the C /C++programming language. Introduction to program design and problem solving using the C /C++programming language. Programming topics include control structures, functions, arrays, pointers, and file I/O.

COURSE OBJECTIVE:

The students should able to

1. familiarize the trainee with the universal concepts of computer programming.
2. present the syntax and semantics of the "C++" language as well as basic data types offered by the language.
3. discuss the principles of the object-oriented model and its implementation in the "C++" language.
4. demonstrate the means useful in resolving typical implementation problems with the help of standard "C++" language libraries

.

COURSE OUTCOMES:

On completion of this course student should be able to:

1. differentiate between structures oriented programming and object oriented programming.
2. use object oriented programming language like C++ and associated libraries to develop object oriented programs.
3. understand and apply various object oriented features like inheritance, data abstraction, encapsulation and polymorphism to solve various computing problems using C++ language
4. apply concepts of operator-overloading, constructors and destructors.
5. apply exception handling and use built-in classes from STL.

RELEVANCE OF COS / POS AND STRENGTH OF CO RELATION:

PO/CO	CO-1	CO-2	CO-3	CO-4	CO-5
PO-a	2	1	1	1	3
PO-b	3	2	1	1	1
PO-j	1	2	1	3	1
PO-l	1	1	3	2	1
PO-g	1	3	1	1	2

1-Weakly correlated 2–Moderately correlated 3–Strongly correlated

COURSE CONTENT:

Introduction to Object Oriented Programming:
Introduction to procedural, modular, object oriented and generic programming techniques, limitations of procedural programming, need of object-oriented programming,

Classes and Objects:
Defining a class, data members and methods, Hungarian notation, public, private and protected members, inline member functions, static data members, static member functions, 'this' pointer, constructors, destructors, friend function, dynamic memory, allocation array of objects, pointers and classes.

Operator Overloading:
Introduction, need of operator overloading, overloading the assignment, binary and unary operators, overloading using friends, rules for operator overloading, type conversions.
Inheritance and Polymorphism:
Concept and need, single inheritance, base and derived classes, friend classes, types of inheritance, hybrid inheritance, member access control, static class, multiple inheritance, ambiguity, virtual base class, polymorphism, virtual functions, pure virtual functions.

Templates:
Introduction, templates: function template and class template, function overloading vs. function templates, member function templates and template arguments.

Introduction to Generic Programming: Introduction to standard template library (STL),containers, iterators and algorithms, study of container template classes for vectors and stacks and related algorithms

Text Books:

1. The Waite Group's Object oriented Programming in C++, R. Lafore, 3rd Edition, Galgotia Publications, 2001, ISBN 81-7515-269-9.
2 Object Oriented Programming with C++ E. Balaguruswamy, Tata McGraw-Hill Publishing Company Ltd, New Delhi ISBN 0-07-462038-X.

Reference Books:

1. C++ Programming Language, B. Stroustrup , 3rd Edition, Pearson Education, 1997, ISBN 0-201-3275542
2. Object-Oriented Programming with ANSI and Turbo C++ , Ashok N. Kamthane, Pearson Education, 2006.
3. Object-Oriented Programming in C++, Rajesh K. Shukla, Wiley India, 2008. 3. Bjarne Stroustrup, “C++ Programming Language”, Third Edition, Addison Wesley, 2002.
4. Let Us C++, Yashavant P. Kanetkar, Second Edition, BPB Publications, 2003.
5. Mastering C++, Venugopal K.R, First Edition, TMH, 1999.

Termwork

a) One assignment on introduction to computer
b) To develop and Run “C++” programs for machine elements like

(Any four on C++)

1) Design of knuckle joint or turnbuckle joint
2) Design of power screw
3) Design of helical spring
4) Design of splines
5) Design of muff coupling
6) Theories of failure etc.

ICA

Internal Continuous Assessment shall support for regular performance of practical and its regular assessment. In addition; it shall be based on knowledge/skill acquired and record submitted by student (journal) based on practical performed by him/her. The performance shall be assessed experiment wise using internal continuous assessment format (S 10).

ME 406 REFRIGERATION AND AIR CONDITIONING LAB

Teaching Scheme: 02P, **Total:** 02 **Credit:** 01
Evaluation Scheme: 25 ICA + 25 ESE **Total Marks:** 50

Internal continuous assessment performance shall be based on ME 401 and consist of following Assignments and Projects

The term work shall consist of minimum eight experiments out of the following:

1. Test on Domestic Refrigerator for evaluation of EER
2. Test on vapour compression test rig
3. Test on air conditioning test rig
4. Test on ice plant test rig
5. Visit to Vapour absorption refrigeration plant
6. Estimation of cooling load of simple air conditioning system (case study)
7. Case study on cold storage
8. Visit to any air conditioning plant
9. Thermal analysis of refrigeration cycle using suitable software
10. Installation and servicing of split air conditioner

Guide lines for ICA:

Internal continuous assessment should support for regular performance of practical and its regular assessment with proper understanding principle of practical completed.

Guide lines for ESE:

Oral will be based on content of syllabus and practical.

ME 407 (A) ELECTIVE – I
AUTOMOBILE ENGINEERING –I LAB

Teaching Scheme: 02 P, **Total:** 02 **Credit:** 01
Evaluation Scheme: 25 ICA + 25 ESE **Total Marks:** 50

Minimum eight experiments shall be performed to cover entire curriculum of course ME 407. The list given below is just a guideline.

List of experiments:

1. Study of layout of transmission system of a two wheel driven and four wheel driven automobile, classification of automobiles, auto body styles.
2. Study of layout of classification of chassis, frame construction, materials for frame, defects in frame, frameless construction, vehicle dimensions.
3. Study of various types of clutches, clutch operation, clutch components and clutch trouble shooting.
4. Study of synchromesh gear box, automatic gear box, continuous variable transmission, lubrication of gear box, gear box trouble shooting.
5. Study of propeller shaft, constant velocity joints, propeller shaft overhaul, propeller shaft trouble shooting, differential, rear axle trouble shooting.
6. Study of leaf springs, torsion bar, shock absorbers, Mac Pherson strut suspension system, stabilizer or anti-roll bar, air suspension, hydrolastic suspension, hydragas inter-connected suspension, suspension system trouble shooting.
7. Study of front axle, steering geometry, correct steering angle, steering mechanism, understeer and oversteer, torque steering, steering linkages, steering gears, power steering, steering adjustment, steering trouble shooting
8. Measurement of steering geometry angle for wheel alignment and study of wheel balancing by visiting wheel alignment and balancing centre.
9. Study of various types of wheels, tyres and tubes, their designations and defects
10. Visit to tyre shop and tyre remoulding unit

Guide lines for ICA: Internal Continuous Assessment shall support for regular performance of practical and its regular assessment. In addition; it shall be based on knowledge/skill acquired and record submitted by student (Journal and sheet) based on practical performed by him/her. The performance shall be assessed experiment wise using internal continuous assessment format (S 10).

Guide Lines for ESE: The End Semester Exam for this course shall be based on oral examination which covers content of syllabus and practical conducted, to judge the skills acquired by student. It shall be evaluated by two examiners out of which one examiner shall be out of institute.

ME 407 (B) ELECTIVE – I
MECHATRONICS SYSTEM LAB

Teaching Scheme: 02P, **Total:** 02 **Credit:** 01
Evaluation Scheme: 25ICA + 25ESE **Total Marks:** 50

Minimum five experiments and three assignments shall be performed to cover entire curriculum of course

Outline of Content: This course contains any five experiments and three assignments.

1) Study of Basic block diagram of Mechatronics system components.
2) Study and demonstration of motion / force transducers.
3) Study and demonstration of temperature / pressure transducers.
4) Study and demonstration of Bottle Filling Plant using PLC
5) Study and demonstration of hydraulic actuator / pneumatic actuator with PLC.
6) Study and demonstration of Lift control using PLC
7) Study of Microprocessors and Microcontrollers
8) Study of Industrial Robot Arm / Autonomous guided vehicle

Guidelines for ICA:
Internal Continuous Assessment shall support for regular performance of practical and its regular assessment. In addition; it shall be based on knowledge/skill acquired and record submitted by student (Journal) based on practical performed by him/her. The performance shall be assessed experiment wise using internal continuous assessment format (S 10)

Guidelines for ESE:
Oral will be based on content of syllabus and practical.

ME 407 (C) ELECTIVE – I
TOOL ENGINEERING LAB

Teaching Scheme: 02P, **Total:** 02 **Credit:** 01
Evaluation Scheme: 25ICA+25 ESE, **Total marks:** 50

Minimum eight experiments and five assignments shall be performed to cover entire curriculum of course and shall be among as following,

1) Draw a tool geometry of – 1) Milling Cutter.
2) Broaching tool.
2) Design of -1) Flat form tool.
2) Circular form tool.
3) Assignment on Economics of Tooling.
4) Design of Drilling Jig.
5) Assignment on Boring, Grinding and Welding Fixture.
6) Design of Limit gauges.
7) Design of Cutting Die.
8) Design of Bending Die.
9) Design of Drawing die.

Guide lines for ICA:

Internal Continuous Assessment shall support for regular performance of practical and its regular assessment. In addition; it shall be based on knowledge/skill acquired and record submitted by student (Journal) based on practical performed by him/her. The performance shall be assessed experiment wise using internal continuous assessment format (S 10)

Guide Lines for ESE:

The End Semester Exam for this course shall be based on oral examination which covers content of syllabus and practical conducted, to judge the skills acquired by student.

ME 407 (D) ELECTIVE – I
DESIGN OF THERMAL EQUIPMENT AND STEAM TURBINE LAB

Teaching Scheme: 02P, **Total:** 02 **Credit:** 01
Evaluation Scheme: 25 ICA + 25 ESE, **Total marks**: 50

Minimum Two experiments and six assignments shall be performed to cover entire curriculum of course ME 402 Elective (D).

List of Experiments

1. Trial on Steam Turbine
2. Trial on compact heat exchanger
3 Trial on double pipe heat exchanger

Guide lines for ICA:

Internal Continuous Assessment shall support for regular performance of practical and its regular assessment. In addition; it shall be based on knowledge/skill acquired and record submitted by student (Journal) based on practical performed by him/her. The performance shall be assessed experiment wise using internal continuous assessment format (S 10)

Guide Lines for ESE:

The End Semester Exam for this course shall be based on oral examination which covers content of syllabus and practical conducted, to judge the skills acquired by student.

ME 408- CAD/CAM LAB

Teaching Scheme: 02P, **Total:** 02 **Credit:** 01
Evaluation Scheme: 25 ICA+25 ESE **Total Marks:** 50

Internal continuous assessment performance shall be based on curriculum of course ME 404 & consist of following Assignments and Project

A. Introduction to Modelling (Using any CAD software).

1. 2D drawing of any three machine components (such as cotter joint, knuckle joint, sleeve joint etc.)
2. 3D modelling using 3D features (Modelling of above mentioned 2D drawing)
3. Assembling and drafting (Above assembly) with proper mating conditions and interference checking.
4. Surface Modelling (Any 2 of the above components).

B. Three assignments based on above syllabus.

Guide lines for ICA:

Internal continuous assessment should support for regular performance of practical and its regular assessment. In addition; it shall be based on knowledge/skill acquired and record submitted by student (journal and sheet) based on performed practicals. The performance shall be assessed experiment wise using internal continuous assessment format.

Guide Lines for ESE:

The End Semester Exam for this course shall be based on oral examination which covers content of syllabus and practical conducted, to judge the skills acquired by student.

ME 409 PROJECT PHASE – I

Teaching Scheme: 02P, **Total:** 02 **Credit:** 02
Evaluation Scheme: 50ICA+50 ESE **Total Marks:** 100

COURSE DESCRIPTION:

The Project Phase – I is one of the most important single piece of work in the degree programme. It is introduced in curriculum to put into practice some of the techniques that have been taught to students in earlier years. It also provides the opportunity to students to demonstrate independence and originality, to plan and organise a large project over a long period. The mini-project topic should be selected to ensure the satisfaction of the need to establish a direct link between the techniques they learnt and productivity. Thus it should reduce the gap between the world of work and the world of study.

DESIRABLE AWARENESS/SKILLS:

Knowledge of concepts, principles and techniques studied in all earlier courses.

COURSE OBJECTIVES:

- The students should able to
- to develop ability to synthesize knowledge and skills previously gained and to put some of them into practice.
- to make students capable to select from different methodologies, methods and forms of analysis studied to produce a suitable system or sub-system.
- to inculcate ability to present the findings of their technical solution in a written report.
- to plan and organise a large project over a long period.

COURSE OUTCOME:

On successful completion of this course students shall

- be able to apply the knowledge and skills previously gained into the practice.
- take appropriate decision w.r.t various parameters related to production of a system or sub-system.
- demonstrate the leadership quality along with ability to work in a group.
- prove the ability to present the findings in a written report or oral presentation.

GUIDELINES FOR REPORT WRITING

for

B. E. and M. E.

(Dissertation, Project & Seminar Report)

Applicable From Academic Year 2012 - 13

GOVERNMENT COLLEGE OF ENGINEERING, JALGAON

Asian Highway No - 46, Jalgaon – 425002 (M.S.).

Phone No.0257- 2281522 Fax No.0257- 2281319

Email-princoej@rediffmail.com Web- www.gcoej.ac.in

CONTENTS

GUIDELINES FOR PROJECT/DISSERTATION REPORT WRITING
(B.E./ M.E.)

1.0 PREAMBLE: The content and the way of presentation of the Project/Dissertation report shows the efforts taken by the candidate(s) for his/her work. Therefore, proper attention shall be paid to the content of Project/Dissertation report which is being submitted in partial fulfillment of the requirements of the respective degree and it is imperative that a standard format be prescribed for the report. This document provides guidelines and standard format for seminar/project/dissertation report writing of UG/PG programs and it may be referred as report writing guide. Some material in this document may be of use in the preparation of any technical report.

2.0 ORGANISATION OF THE REPORT: The report shall be presented in number of chapters starting with introduction and ending with conclusion. Each of the chapters should have precise title reflecting the contents of that chapter. A chapter can be divided and subdivided into sections and subsections so as to present the content discretely and with due emphasis. In addition to main material of the report; preliminaries, references, appendices etc should be included in the report.

2.1. Sequence of Contents: The material should be placed and bound in following order:

i) Preliminaries: The following information should be furnished in the given sequence.

Top Sheet of transparent plastic
Title page
Certificate
Declaration
Acknowledgement
Abstract
Table of Contents
List of Figures
List of Tables
Nomenclature
Acronyms if any

ii) The Chapters (Main material):

It shall be presented in number of chapters starting with introduction and ending with conclusion as explained in section 4.

iii) Appendices:

iv) References:

v) Publications:

3.0 PRELIMINARIES:

3.1. Title Page: It is a first page of report. Try to find a title that clearly describes the work you have done and be as precise as possible. Mention Dissertation/ Project / Seminar title your name, guide's (and co-guide's) name, name of the department (i.e. Electronics and Telecommunication Engineering etc), name of the institute, place, month and year of the submission of report. .

3.2. Abstract: Summarize the main points of the report on a separate page. Persons interested in the report after reading the title should be able to judge from the abstract whether the report is really interesting for them. So, briefly formulate the problem that has been defined / investigated, the solutions derived, the results that have been achieved, and your conclusions. The abstract should not occupy more than one page (about

150 to 200 words). It must contain the context/ relevance of the problem at hand, a description of what was done and a gist of the significant observations/ results. It's noteworthy that the abstract shall be prepared after project work is over and report is completed in all respect. This page should precede the ToC page.

3.3 Certificate and Declaration: Both pages shall be in the unique format provided with this guide and duly signed by student, guide and all the authorities with date.

3.4 Acknowledgement: Please keep this brief and resist the temptation of writing flowery prose. Do include all those who helped you, e.g. other faculty / staff you consulted, colleagues who assisted etc. Acknowledgement shall be included only in the final report and not in phase I or phase II as the case may be.

3.5 Table of Contents (ToC): Refer page no 11

- It should list items in the following order.

- Certificate (before T`oC)
- Declaration (before T`oC)
- Acknowledgement (before ToC)
- Abstract (before ToC)
- List of figures (1.1, 1.2, 1.3.., 2.1, 2.2, .. etc.) (after ToC)
- List of tables (1.1, 1.2, 1.3.., 2.1, 2.2, .. etc.) (after ToC)
- Nomenclature (after ToC)
- Acronyms if any (after ToC)
- The chapters (1, 2, … N, followed by the name of the chapter),
  - Sections within chapters (e.g. 1.1, 2.4, etc. + name)
    - Subsections within sections (e.g. 1.1.1 + name)
- Appendices (I, II, III, IV, .. etc. + name), if any
- References
- Publications if any

- Do not include the table of contents itself in the ToC.

- Use borderless table for ToC

3.6 List of Figures and Tables: Tables and figures should be numbered and captioned. Each table or figure should be numbered using a two-level scheme, (chapter no).(table no) or (chapter no).(figure no). This number (e.g. Table 4.8, or Fig. 3.7) should be used whenever the table/figure is referred in the text. Each table/ figure should have a title/caption. An identical entry should exist in List of Tables or List of Figures respectively. Title of a table is given at the top of the table preceded by its number. Caption of a figure is given at the bottom of the figure preceded by its number. Figures and tables should appear as close as possible to their first occurrence/mention in the running text of the chapter these belong to; these must appear after the first mention and not before. Photocopied tables should not be included. Photocopied figures should be avoided as far as possible and if included they should be large enough and clear. If taken from any reference, the reference should be cited within the text as well as at the caption of the figure or table.

3.7 Nomenclature: It is necessary whenever symbols are used. This is in order of English (i.e. Roman) letters (Uppercase followed by lowercase), Symbols in Greek letters (see Appendix for the alphabetical order of Greek letters), subscripts and superscripts used, Special Symbols, followed by acronyms (i.e., Abbreviations) if any; everything in alphabetical order. All entries in nomenclature should have appropriate units in SI system.

3.8 Numbering of Report: Every page of the report other than the title page should be numbered. Pages of Certificate, Acknowledgement, Table of Contents, Nomenclature, List of Tables and List of Figures should be numbered with lower case Roman numerals (i, ii, iii, iv, …etc.). From the first page of the first chapter onwards, all the pages should be numbered using Hindu-Arabic numerals (1, 2, 3, … etc.). The page numbers should appear at the bottom center as it is appearing in this document.

4 The Chapters: The number of chapters you need and their contents strongly depend on the topic selected and the subject matter to be presented. In general the following chapters may be included; however, it is your own report and you have to structure it according to the flow of overall logic and organization.

4.1 General Guidelines:

- Each chapter, section, subsection, etc. should have a title. An identical entry should exist in the ToC. Each chapter is numbered using Hindu-Arabic numerals: 1, 2, 3, ..
- Title with interrogative sentence should be avoided.
- The chapters may be structured in to sections and subsections. Sections within a chapter are numbered using a two-level scheme, (chapter no).(section no); for example, sections in chapter 3 are numbered 3.1, 3.2, ... Subsections within a section are numbered using a three-level scheme, (chapter no).(section no).(subsection no); for example, subsections in chapter 3, section 2 are numbered 3.2.1, 3.2.2, ... The sections and sub-sections must carry titles. Use different fonts for section titles and sub-section titles as specified in section 7.3.2 on page no 7.
- Presentation of your contributions should include formulation, derivations, description of experimental set-up, experimental data/measurements, design calculations etc. For an experimental investigation, raw data must be available (preferably in an appendix). For a project involving software development, user's manual, programmer's manual, source code diskette/listing must be available. User's and programmer's manuals are considered to be separate documents, distinct from your report. As mentioned previously, these could form appendices.
- The SI system of units should be used as far as possible.
- Results/ Discussion/ Comments: If there are too many aspects to be covered then organize them in a logical manner.

4.2 Introduction: In this chapter give introductory information about your project/dissertation/seminar and formulate the problem that you want to address, the statement of a problem and its relevance, the initial goals you had, etc. without going into details. Here you also describe the structure of the rest of your report, indicating which chapter will address which issue.

4.3 Literature Survey: It should be as exhaustive as possible but related to your work. The discussion on the literature may be organized under a separate heading & titled suitably. Summarize the literature that you have read. Rather than literally copying the texts that you have read, you should present your own interpretation of the theory. This will help you in developing your own thinking discipline and technical language. The last part of this section must contain a brief mention of the gaps in the literature and a justification for undertaking your study/project. Do not be too general. Avoid writing essays on historical developments.

4.4 Theory-Oriented Chapters: The basic theory necessary to formulate the subject matter may be presented under this chapter & titled suitably.

4.5 Practice-Oriented Chapters: Depending on the work that you have done, it might be important to write about the system specifications/design, practical details, system behavior and characteristics and cross links of the selected topic etc.(May be one or two chapters) eg Hardware Design, Software Development, Results and Discussion etc.

4.6 Conclusions: This is one of the most important chapters and should be carefully written. It should be broadly divided as objective or introduction, conclusions and future scope. Here you evaluate your study,

state which of the initial goals was reached and which not, mention the strong and weak points of your work, etc. You may point out the issues recommended for future research. State these clearly, in point-wise form if necessary, with respect to the original objective. Do not disguise "descriptions" of specific aspects, covered in the work as conclusions.

4.7 Equations: Each equation should be numbered using a two-level scheme, (chapter no).(eq no). While typing, the equations should be centrally placed while equation numbers should be flush right. (LaTeX does this by default.) This number (e.g. 2.4, with 2 as chapter number and 4 as equation number) should be used (as Eqn. 2.4) whenever the equation is referred in the text. The equations should be clearly written. Symbols used in the equations should be explained immediately after the equation when they are referred first as well as in the nomenclature. SI units must be used throughout the report. Present equations in dimensionless form, wherever possible and appropriate.

4.8 Acronyms: Avoid acronyms (short forms) in the report except the following standard ones. Equation(s): Eq(s), Figure(s): Fig(s). The words 'Table' and 'Chapter' are not shortened. If any other acronyms have to be used, list them separately at the beginning (after nomenclature). Mention the acronym in the brackets following its full form, whenever it occurs first. The first word in a sentence shall never be a short form.

5.0 The Appendices: Appendices are useful for those things that you consider important, but that do not fit in the main presentation of your work and breaks the regular flow. There could be several reasons for using appendices: the material is too long and has too many details (e.g. the specifications of instruments or equipment), you have formulated a theorem, the proof of which is too long for the main text, you want to include a user manual for the software that you have come across (strongly recommended!), you want to present the schematics of a hardware design, experimental set-up, etc. Appendices tend to occupy many pages. Think carefully on what you want to include. For example, complete listings of the source code that you have written are seldom interesting. Instead, add a flow chart. Avoid describing the test set-up where a schematic can be easily used. Appendices are numbered as Appendix I, Appendix II, etc. or using capital English letters e.g. Appendix A, Appendix B, etc. If you have just one appendix, then it is not numbered. Alphabetical order of Greek letters: Alpha, beta, gamma, delta, epsilon, zeta, eta, theta, iota, kappa, lambda, mu, nu, xi, omicron, pi, rho, sigma, tau, upsilon, phi, chi, psi, omega. Since reference can be drawn to published/unpublished literature in the appendices these should precede the reference (or Literature Cited) section.

6.0 References: This should follow appendices, if any, otherwise the conclusion chapter. This chapter is also referred as “Literature Cited”. Each entry in the reference has a label. All references cited in the text-body should be there in the Reference list and vice versa. Established acronyms may be used. e.g. AC, DC, ASME, ASTM, IIT, Jnl, etc., provided there is no likelihood of any confusion.

- **Labeling:** One of the following systems can be used for labeling the cited entries.

System 1: A numeric label arranged in an order of citation in the main text. This label is used in square brackets or as superscript at the point of citation, e.g. [34]. The references should be arranged together in the order of this numeric label.

System 2: A label derived from the authors name and the year of publication. For entries with 2 authors, include the surnames of both the authors followed by the year of publication. For entries with multiple authors, include the surnames of the first author followed by ‘et al.’ and the year of publication. This label is used in round brackets at the point of citation, e.g. (Taylor, 1982) or (Taylor et al., 1982) or (Taylor and Morgan, 1982).

- The references should be arranged together in the alphabetical order of the author surname (1st priority) and the year of publication (2nd priority).

- The reference list thus compiled together should be included after Appendices. In the reference list, you should provide the details of each entry in the following manner. These details differ depending on the type of bibliographic entry.

- For a book: name of the authors, title, publisher, city of publication and year of publication. (Taylor J. R., An Introduction to Error Analysis, Oxford University Press, Mill Valley, CA,USA, 1982)

- For an article in a journal: name of the authors, title, name of the journal, volume (issue number), range of pages, and year. (Bandyopadhyay S., Bera N.C. and Bhattacharyya S., 'Thermo economic Optimization of Combined Cycle Power Plants', Energy Conver. Mgmt., 42(3), 359-371, 2001.)

- For an article in conference proceedings: name of the authors, title, name of conference, editors (if present), range of pages and year. (Kedare S.B. 'Optics, Design, Performance and Economics of the Dynamic Fresnel Paraboloid Reflector Concentrator Dish with Point Focus for High Temperature Solar Thermal Applications', Proceedings of National Renewable Energy Convention '99, Sawhney R.L. (Ed.), 9-15, 1999.)

- A chapter in a book: authors of the chapter, title of the chapter, editors of the book, title of the book, publisher, city of publication, range of pages, and year of publication.(Bilgen E., Industrial Solar Power Stations, Veziroglu T.N. (Ed.), Solar Energy and Conservation: Technology, Commercialization, Utilization, Volume2, Pergamon Press, NY, USA, 665- 673,1978)

- A report: authors, title, university/company, report number, year. (Ahmed K., Renewable Energy Technologies, World Bank Technical Paper Number 240, 1994)

- A Ph.D. or Masters Thesis: author, title, department, university, year. (Kedare S.B., 'Investigations on a Reciprocating Wind Machine', Ph.D. Thesis, Dept. of Mechanical Engineering, IIT, Mumbai, 1991)

- A manual / handbook / standards : company name (if there are no authors), title, reference number, year. (British Standards Institution, Specification for Steel girder bridges, BS153 : Parts 3B & 4 : 1972, 1972)

- A web-site : Author or Organization, name of the site, complete address of the site, date visited (Danish Wind Industry Association, Aerodynamics of Wind Turbines: Lift, http://www.windpower.org /tour/wtrb/lift.htm, Aug 16, 2002)

- **Bibliography:** In a few exceptional cases, it is useful to suggest a list of publications for background reading. These are not cited anywhere in the text. This list can be included as 'Bibliography'. It should follow 'References' on a fresh page.

7.0 Additional Guidelines For Seminar/ Project Reports: Following are the additional important guidelines which shall be followed by all students.

7.1 Interaction With Guide: It is recommended that you meet your guide regularly during the course of the seminar/project, though ultimately the form of this interaction depends on both of you. You should maintain a record notebook/file where you can include a record of your discussions with your guide, literature survey details, derivations etc. Such a system will allow easy and quick access to the details and chronology of your work. The final responsibility for producing an error-free report lies with you, and not your guide.

7.2 Submission: Students shall follow the following guidelines for final submission.

- First, get draft copy of your report approved and certified by your guide and HoD.
- Submit only one copy per group of above report in spiral binding form to the Principal through HoD of your department on or before due date.
- Once the report is approved by the Principal then submits appropriate number of copies of final report in hard bound form.

- Number of copies to be submitted is no. of student + guide + library +department + no of examiners. The bound copies of your report should be submitted within the given deadline. Late submission may not be acceptable. Make sure that the certificate in your report is signed by concerned authorities before you make the final submission of the report.

7.2.1 Binding: The report shall be hard cover bound in leather or rexin (Black colour for B.E., Maroon for M.E.). The front cover shall be same as top cover page and all lettering shall be embossed in gold. In addition, emboss the title of project/dissertation/seminar, name of programme and month & year of submission on side strip of the report. At the time of final submission, if examination number is not allotted by NMU, Jalgaon; then don't emboss that line on top cover page.

7.3 Format:

7.3.1 Paper : It is mandatory to use plain A4 sized (height 297 mm, width 210 mm) good photocopying paper sheets, 70 to 90 gsm (16 to 20 pounds), whiteness 95% or above, smooth finish.

7.3.2 Typesetting, Text Processing and Printing:

- All material should be typed in 1.5 line spacing using times new roman and the vertical space between paragraphs shall be 2.5 line spacing. The first line of each paragraph should normally be indented by six characters.

- The recommended margins are 25 mm (1 inch) for top, bottom, right and left with an extra 13 mm (0.5 inch) for binding on the left. Other than page numbers, no material should intrude into these margins.

- Each chapter should commence with a chapter number (12 TNR Bold title case) and title (14TNR Capital Bold). The text should begin on the same page with 2 blank lines of 1.0 line spacing between the last line of the chapter title and the first line of your text material. Keep 1 blank line of 1.0 line spacing between the chapter number and the title of the chapter. Adjust the chapter number and the title to fall in the center of the page.

- Use Capital Bold, TNR 12 font for all two level subtitles in the chapter.

- Use Title Case (Each word capital) Bold, TNR 12 font for all three level subtitles in the chapter.

- Use Sentence Case (First word capital) Bold, TNR 12 font for all four level subtitles in the chapter.

- Use Title Case (Each word capital), TNR 12 font for all titles/captions of tables/figures.

- Use TNR 12 font for writing the text.

- All pages, including figures and tables, should be numbered. Figures and tables should be complete in all respects (legends, number, caption/title, reference (if any), coordinate labels with units). Experimental data should typically be represented by centered symbols, while theoretical data by continuous curves in figures. Photographs should be treated as being equivalent to figures, with the caption being placed at the bottom of the photograph.

- When displaying computer code listings (usually in an appendix) please ensure that these contain appropriate comment statements so that the code can be understood easily. It is always desirable to have a high degree of similarity between the variables names / symbols that you have used in the report and those which appear in the code (e.g. *D* and RHO etc.)

7.3.3 Page Limits: Avoid writing a report which is artificially fattened. Do not waste pages. Use space optimally.

7.4 Publications by the candidate: Papers, articles, technical notes etc. on the topic of the project/dissertation published by the candidate may be separately listed after the references. This may also be included in the contents. The candidate may also include reprints/zerox copy of proceeding of his/her publication after the references.

7.5 General Guidelines

- Please maintain consistent tense in your report.
- Do not keep flipping between past and present tense.
- It has been the norm to use the passive voice ("was done") in technical writing.
- A paragraph should normally comprise of more than one line.
- Only one line of any paragraph should not be left at the top or bottom of the page.
- Pay attention to detail and accuracy.
- Be clear, but concise.
- **Please make a sincere effort to weed out typographical errors. Remember, these mistakes will cost your marks and may even result in a re-submission.**
- If you have become tired of reading your report over and over again and suspect that this fatigue will cause you to overlook typos and grammatical mistakes get a friend to help you out (perhaps you can also provide similar help in reciprocation).
- Write introduction and conclusion after writing the main body of the report.
- Write the numbers 0 to 9 in words and the numbers > 9 in figure.
- Repetitions in the titles of figures and tables be strictly avoided.
- **All tables and figures included in the report shall be referred in the text.**
- If the candidate so desire he/she may dedicate the thesis/report to someone. The dedication statement shall be presented on separate page which shall follow the title page and it is neither numbered nor included in ToC.

7.5 Expectations From Work

- Literature survey of related work with a clear identification of gaps in the literature and the justification and desirability of undertaking the study.
- Theory / model equations including method of solution. This section may also contain a detailed rebuttal of some previous study.
- Experiment / design of experiments, description of equipment and materials, methods of analysis. This section may include a critique of some previous experimental work
- Salient observations on the results you have obtained such as the relationships between different variables and parameters, unusual trends, interpretations of the observed trends, comparison between theory and experiment, comparison with previous literature, limitations, justification of prior assumptions made, and inconsistencies.

- Summary of salient observations and trends, how the study filled some gaps in the literature, scope and desirability of further work on the problem, applications, potential areas

Guide lines for ICA:

Internal continuous assessment should support for regular performance and its regular assessment. In addition; it shall be based on knowledge/skill acquired and record (log book) submitted by student (log book) based on performance. The performance shall be assessed presentation or demonstration wise using internal continuous assessment format.

Guide Lines for ESE:

The End Semester Exam for this course shall be based on oral examination which covers content of Project, to judge the skills acquired by student.

ME 410 SEMINAR

Teaching Scheme: 02 P, **Total:** 03 **Credit:** 02
Evaluation Scheme: 50ICA **Total:** 50

COURSE DESCRIPTION: The course explores the knowledge of presentation and effective communication. The course develops ability to work on multidisciplinary teams, Identify, formulate, and solve engineering problems in view of economic, environmental and societal context.

PREREQUISITE COURSE(S):
Knowledge of science, mathematics, computer programming and core subject of engineering

COURSE OBJECTIVES:
The objectives of Seminar are to develop ability express our view, presentation and effective communication. The scope of seminar-II is study various national and international journal for design, experiments conduct, as well as to analyze and interpret data within realistic constrain such as economic, environmental, social, safety and manufacturability.

CONTENT :-
1. Each Student shall select a topic for seminar which is not covered in curriculum. Seminar topic should not be repeated and registration of the same shall be done on first come first serve basis.
2. Topic of Seminar shall be registered within a three weeks from commencement of VII Semester and shall be approved by the committee.
3. The three-member committee appointed by Head of the department shall be constituted for finalizing the topics of Seminar. Seminar shall be related state of the art topic of his choice approved by the committee.
4. Each student should deliver a seminar in scheduled period (Specified in time table or time framed by department) and submit the seminar report (paper bound copy/Thermal bound)in following format: a. Title b. Abstract c. Introduction d. Literature survey e. Concept f. Functional and Technical Details g. Applications h. Comparison with similar topics / methods i. Future scope j. References ASSESSMENT OF SEMINAR
5. follow all project guidelines of report writing for seminar report writing.

Guide lines for ICA:
ICA shall be based on topic selection, presentation and Seminar report submitted by the student in the form of thermal bound. Assessment of the Seminar-II for award of ICA marks shall be done jointly by the guide and a departmental committee, as per the guidelines given in **Table- B**
Presentation seminar topic shall be performed by the each student at the end of tem by at least 03 (guide may be default member) committee member of department assigned by HoD.
Summative Assessment of each student at the time of seminar presentation shall be assessing by referencing following format,

Assessment of seminar

Name of Guide: - Name of two internal evaluator: - 1. 2.
Class: - Semester:- A- Year:-
Table-B

PRN No.	Name of Student	Seminar Topic	Topic Selection (05)	Literature survey (05)	Report writing (05)	Depth of understanding (05)	Presentation (05)	Total (25)

Remark, if any,

_____

_____

(Evaluated by three committee member of dept. and dully signed on such format).

ME 411 SELF STUDY – III

Teaching Scheme: 00**, Total:** 00 **Credit:** 02
Evaluation Scheme: 50 **Total Marks:** 50

Content and Guide line:-

The 20% syllabus for self - study shall be declared by subject teacher of FOUR subjects at the beginning of semester and he/she shall conduct the test examination for that course, assess answer papers of test examination and submit the marks to course coordinator.

Marks and hence grade of course Self Study I shall be based on one test each conducted on 20% syllabus of five subjects ME401, ME402, ME403 and ME404. One faculty member should be appointed as course coordinator for the course ‘self study’ to compile the marks of all tests and enter into the MIS.

GOVERNMENT COLLEGE OF ENGINEERING, JALGAON.

Department of (Mechanical Engineering).

Scheme for B. Tech. (Mechanical Engineering)

SEM VIII

Course Code	Name of the Course	Group	Teaching Scheme Hrs/week				Evaluation Scheme							Credits
							Theory				Practical			
			TH	TUT	PR	Total	ISA	ISE1	ISE2	ESE	ICA	ESE	Total	
ME451	Finite Element Method	D	3	---	---	3	10	15	15	60	---	---	100	3
ME452	Project and Financial Management	D	3	---	---	3	10	15	15	60	---	---	100	3
ME453	(Elective II)	E	3	---	---	3	10	15	15	60	---	---	100	3
ME454	(Elective III)	E	3	---	---	3	10	15	15	60	---	---	100	3
ME455	Finite Element Method Lab	D	---	---	2	2	---	---	---	---	25	25	50	1
ME456	(Elective II) Lab	E	---	---	2	2	---	---	---	---	25	25	50	1
ME457	(Elective III) Lab	E	---	---	2	2	---	---	---	---	25	25	50	1
ME458	Project Phase- II	D	---	---	4	4	---	---	---	---	50	50	100	4
ME459	Industrial Visit/ Training	D	---	---	---	---	---	---	---	---	50	---	50	1
ME460	Industrial Lectures	D	1	---	---	1	---	---	---	---	50	---	50	1
ME461	Self Study IV	D	--	---	---	---	---	---	---	---		---	50**	2
		Total	**13**		**10**	**23**	**40**	**60**	**60**	**240**	**275**	**125**	**800**	**23**

TH: Theory Lecture, TUT: Tutorial, PR: Practical
ISA :Internal Sessional Assessment ISE: In Semester Examination ESE: End Semester Examination ICA : Internal Continuous Assessment

Elective II

A Power Plant Engineering
B Automobile Engineering - II
C Machine Tool Design
D Process Equipment Design

Elective III

A Advance Machine Design
B Mechanical Vibrations
C Tribology
D Computational Fluid Dynamics

- **Marks and hence grade of course Self Study shall be based on one test each conducted on 20% syllabus of four subjects – ME451, ME 452, ME453, ME 454. One faculty member should be appointed as course coordinator for the course 'self study' to compile the marks of all tests and enter in to MIS.**
- **The 20% syllabus for self - study shall be declared by subject teacher at the beginning of semester and he/she shall conduct the test examination for that course, assess answer papers of test examination and submit the marks to course coordinator.**
- **In the course Industrial Lectures, at least 12 lectures from industrial expert should be arranged and continuously assessed (06 lectures in VIth and VIIIth semester each).**

ME 451 FINITE ELEMENT METHOD

Teaching Scheme: 03L+02P**, Total:** 05 **Credit:** 03
Evaluation Scheme: 15 ISE1 + 15 ISE2 + 10 ISA + 60 ESE **Total Marks:** 100
Duration of ESE: 03 hours

COURSE DESCRIPTION:

Course introduces undergraduate students to Finite Element Analysis and Simulation Technique. The course aims at imparting knowledge of Finite Element Analysis and Simulation Technique.

DESIRABLE AWARENESS/SKILLS:

Fundamental knowledge of Mathematics, Mechanics of Material and Machine Drawing.

COURSE OBJECTIVE:

The students should able to

1 introduce the concepts of Mathematical Modelling of Engineering Problems.
2. study the applicability of FEM to a range of Engineering Problems.
3. acquaint with applications of numerical techniques for solving problems.

COURSE OUTCOMES:

On completion of this course; student shall be able to:

1. Apply finite element method to solve problems in solid mechanics, fluid mechanics and heat transfer.
2. Formulate and solve problems in one dimensional structures including trusses, beams and frames.
3. Formulate FE characteristic equations for two dimensional elements and analyze plain stress, plain strain, axi-symmetric and plate bending problems.
4. Implement and solve the finite element formulations using MATLAB.

RELEVANCE OF COS / POS AND STRENGTH OF CO- RELATION:

PO \ CO	CO1	CO2	CO3	CO4
PO-a	3	2	1	1
PO-b	3	3	2	2
PO-c	3	3	2	2

1-Weakly correlated 2 – Moderately correlated 3 – Strongly correlated

COURSE CONTENTS

Introduction to FEA

Introductory Concepts: Introduction to FEM , Discretization going from part to whole approach, Physical problem, mathematical models and finite element solution, FEA as an integral part of CAD. FEM Software's - Pre-processing, processing and post processing. Advantages and disadvantages of FEM.

Conventional Numerical Methods- Finite difference method, weighted residual techniques, method of Least squares, Galerkin methods, Rayleigh- Ritz method, and Boundary Value problems, Displacement methods, equilibrium method.

Finite Elements Types: One dimensional element such as two nodded & three nodded Spar or truss element. Two and three dimensional elements, triangular, rectangular quadrilateral.

One-Dimensional Analysis

Discretization. Derivation of Shape functions, interpolation function, Stiffness matrices, global stiffness matrix, application of boundary, and force vectors.

Assembly of Matrices - solution of problems in one dimensional structural analysis, Stepped and Taper Bars, Torsion of circular shaft, thin wall tubes steady state heat conduction& convection, laminar pipe flow.

FEM direct approach elements stiffness, potential energy approach, treatment of boundary conditions, temperature effects.

Analysis of Plane Trusses, Analysis of Beams.

Two-Dimensional Analysis

Introduction. Finite element analysis for two dimensional problems. Natural coordinates and coordinates transformations, Derivation of shape functions for triangular element. Application of heat transfer, analysis of structural vibration. Finite element formation of beams.

Two Dimensional Vector analysis

Equations of elasticity – Plane stress, plane strain problems. Automatic mesh generation and imposition, Eigen value problems. Jacobian matrix, stress analysis of CST element. Applications to free vibration problems of rod and beam. Lumped and consistent mass matrices.

Simulation Theory and Application

System models and studies: - concepts of a system, system environment, stochastic activities, continuous and discrete systems, system modelling, types of models, principles used in modelling, types of system studies.

System simulation:-The techniques of simulation, Monte Carlo method, comparison of simulation and analytical methods, analog computers and methods, hybrid computer, simulators, continuous system simulation languages, system dynamics, growth models, logistic curves, multi segments models, probability concepts in simulation, system simulation, events, representation of time, arrival pattern.

Text Book

1. Seshu P, "Textbook of Finite Element Analysis", PHI, Eastern Economy Edition, 2012
2. Reddy, J. N., "Finite Element Method in Engineering", Tata McGraw Hill, 3rd edition 2007.

Reference Books

1. Singiresu S. Rao, "Finite element Method in Engineering", 5th edition 2012
2. Zeincowicz, "The Finite Element Method for Solid and Structural Mechanics", 4th Edition, 2007.
3. C. S. Krishnamoorthy., "Finite element analysis", TMH, 2nd edition 2007
4. Klaus-Jurgen Bhate, "Finite element analysis", PHI.
5. Kenneth Lt. Huebner, "The FEM for Engineers", Wiley India Pvt. Ltd. New Delhi, 4th edition, 2001

ME 452 PROJECT AND FINANCIAL MANAGEMENT

Teaching Scheme: 03L**, Total:** 03 **Credit:** 03
Evaluation Scheme: 15 ISE1 +15 ISE2 + 10 ISA + 60 ESE **Total Marks:** 100
Duration of ESE: 03Hrs

COURSE DESCRIPTION:

This course introduces undergraduate students to imparting knowledge of project & business management. The background required a sound knowledge of network technique, organization structure, Financial and material management.

COURSE OBJECTIVES

Student should be able to

1. Provide about project and its management.
2. Develop knowledge about organization and impart knowledge about functioning of management.
3. Develop knowledge about financial management techniques.

COURSE OUTCOME

On completion of this course student should be able to:

1. Develop knowledge of project management and statistical tools used in its.
2. Helped to understand the various functions of management along with its types.
3. Develop knowledge about Capital cost and cost control.

RELEVANCE OF COS / POS AND STRENGTH OF CO- RELATION:

PO/CO	CO1	CO2	CO3
PO - e	2	3	2
PO - i	3	2	2
PO - k	3	2	2
PO - l	3	1	1
PO - m	3	2	2

1) Weak 2 Moderate 3) Strong

COURSE CONTENTS

Project Management

Introduction to project management, Concept of project management, Managerial function at different organizational levels, Types of projects, Project identification, scheduling, Monitoring, Control, Basic tool & techniques for projects scheduling Bar chart, Project life cycle curves, Line balancing, Problems on Line balancing.

Project statistic technique

Introduction of Network technique, Fundamental concept and network models, construction of network diagrams, Application of network analysis, definition of PERT and CPM, comparison between CPM and PERT, Critical path method with problem, programme evaluation and review techniques with problem, time cost problem (crash) with PERT.

Business management

Introduction to management, Concept of management, The function of management, importance of management Forms of business organisation, Concept of Ownership Organization, Types of ownership, Individual Ownership, Partnership organization, joint stock companies, types of stock companies,Co-operative Organisations, various types of co-operative societies, Public sector organization, State ownership, public cooperation, choice of form of organisation, comparative evaluation of different forms of business ownership.

Financial Management

Introduction, Definition of financial management, functions of financial management, Sources of Funds, Capital, classification of capital, working capital, need for working capital, assessment of working capital, Factors affecting working capital, Sources of finance (Shares, debentures, loans from banks, trade credit public deposits financial institutions). Cost and cost control: Elements of cost, direct cost, indirect cost, variable and fixed cost, cost control technique, marginal costing, break even analysis.

Material and Purchase Management

Scope of material management, function of material management, objectives of scientific purchasing, functions of purchase department, , 5R's Of Buying, Methods of buying, source selection (vendor),vendor rating, just in time purchasing. Inventory management, Objective of inventory management, types of inventory, selective inventory technique (ABC,VED), Inventory model (Economic lot size with fixed price, EOQ with quantity discount).

Text Books

1. Production(Operation)Management, L. C. Jhamb , Everest publishing house
2. Theory And Problems in Production and Operations Management, Chary, 2nd Reprint, Tata McGraw Hill Publishing Co. New Delhi., 1996.
3. Production & Operations Management, Nair, N.G., Tata McGraw Hill Publishing Co. New Delhi, 1997.

References Books

1. Fundamentals of Financial Management, Chadra Presanna, Tata McGraw Hill New Delhi,1994.
2. Marketing Management, Kolter Philip, Prentice-hall of India,1988.
3. Fundamental of Financial Management, Vyuptakesh Sharan.,Pearson Education
4. Industrial engineering and production management, Martand telsang,1st Edition reprint 2013-S.chand & company ltd. New Delhi, 2013
5. Financial Management, M.K.Khan & P.K.Jain, Tata McGraw Hill Publishing Co. New Delhi.
6. Business Management, J.P.Bose, S.Talukdar, New Central Agencies (P) Ltd.

ME 453 (A) Elective-II
POWER PLANT ENGINEERING

Teaching Scheme: 03L+02P**, Total:** 05 **Credit:** 03
Evaluation Scheme: 15 ISE 1 + 15 ISE 2 +10 ISA +60 ESE **Total Marks:** 100
Duration of ESE: 03 Hrs

COURSE DESCRIPTION:
To understand the various components, operations and applications of different types of power plants.

COURSE OBJECTIVES :
Student should be able to

1. Define terms and factors associated with power plant economics.
2. Calculate present worth, depreciation cost of different types of power plants.
3. List types, principles of operations, components and applications of steam turbine power plants, steam generators.
4. Describe basic working principles of gas turbine and diesel engine power plants.
5. Define the performance characteristics and components of such power plants.
6. List the principal components and types of nuclear reactors.
7. Understand the basics of pollution from power plants, thermal pollution, air pollution, and its environmental effects.
8. Understand the various devices for energy storage.

COURSE OUTCOMES:
On completion of this course student should be able to:

1. Analyze the economics of power generation.
2. Understand basics of steam turbine power plants.
3. knowledge of power generation systems like thermal power, hydraulic power, nuclear power
4. knowledge of environmental impact of power plant and their remedies
5. Knowledge of various energy storage devices.

RELEVANCE OF COS / POS AND STRENGTH OF CO- RELATION:

PO/CO	CO-1	CO-2	CO-3	CO-4	CO-5
PO-a	1	2	2	-	-
PO-b	3	3	3	2	--
PO-c	2	1	2	1	-
PO-g	-	1	1	2	
PO-h	3	2	3	3	2

1-Weakly correlated 2 – Moderately correlated 3-Strongly correlated

COURSE CONTENTS:

Thermal Power Plants

Thermal power stations. Main components and working of power stations, thermodynamics cycles, fuel handling, combustion and combustion equipment, problem of ash disposal, circulating water schemes and supply of makeup water. Choice of pressure of steam generation and steam temperature, selection of appropriate vacuum economizer, air pre-heater, feed water heaters and dust collection. Characteristics of turbo alternators, steam power plant, heat balance and efficiency. Boilers and steam generation, general classification, fire tube and water tube boilers, natural circulation and forced circulation boilers, high pressure, high temperature boilers, supercritical pressure boilers, boiler mounting and accessories, feed pumps, economizers, super heaters, air pre-heaters; boiler furnaces, heat generation rates, water walls.

Diesel and Gas turbine Power Plant

Diesel power plants: Diesel engine performance and operation, plant layout, log sheets, selections of engine size. b Gas turbine plants: Plant layout, methods of improving output and performance fuel and fuel systems, methods of testing, open and closed cycle plants, operating characteristics.

Hydroelectric and Nuclear Power Plant

Hydroelectric plants: Penstocks, water turbines, specific speed, turbine governors, hydro-plant auxiliaries, plant layout, automatic and remote control of hydro-plants, pumped projects, cost of hydroelectric project. Nuclear power plants: Elements of nuclear power plants, nuclear reactor fuel moderators, coolants, control. Fusion energy: Control through fusion of hydrogen and helium. Energy release rates-present status and problems. Future possibilities.

Renewable Energy Power Plant

Basic bio-conversion mechanism; source of waste; simple digester; composition and calorific values of bio-gas. Wind energy generation; Special characteristics; Turbine parameters and optimum operation; Electrical power generation from wind/tidal energy. c Ocean thermal energy conversion; Geothermal energy-hot springs and steam injection; Power plant based on OTEC and geothermal springs.

Solar Energy Power Plant

Energy from the sun: Techniques of collection; Storage and utilisation; Types of solar collectors; Selective surfaces; Solar thermal processes; Heating; Cooling; Drying; Power generation, etc.
Direct energy conversion methods: Photoelectric, thermoelectric, thermionic, MHD (magneto-hydrodynamics) and electro-chemical devices; Solar cells, Solar Concentrators

Text Book

1. P K Nag, “Power Plant Engineering”, Tata McGraw Hill
2. R K Rajput, “Power Plant Engineering”, Laxmi Publications (P) Ltd.
3. Arora and Domkundwar,”A Course in Power Plant Engineering”, Dhanpat Rai & Co., Delhi
4. R. Yadav - Steam and Gas turbines, central publishing house, Allahabad

Reference Books

1. M. M. El Wakil, “ Power plant technology”, Tata McGraw Hill
2. M Khopkar, “ Environmental Pollution : Monitoring and Control”, New Age International Publishers
3. Dr B B Parulekar, “ Energy Technology”, Khanna Publishers, Delhi
4. A K Raja, “Power Plant Engineering”, New Age International Publishers, Delhi

ME 453 (B) Elective-II
AUTOMOBILE ENGINEERING – II

Teaching Scheme: 03L+02P**, Total:** 05 **Credit:** 03
Evaluation Scheme: 15 ISE1 + 15 ISE2 + 10 ISA + 60 ESE **Total Marks:** 100
Duration of ESE: 03 Hrs

COURSE DESCRIPTION:

The purpose of this course is to impart adequate knowledge in both practically and theoretically, covering the various components and to familiarize the students with the **to** automobile components and their constructional details, brakes, cooling system, lubrication system, storage batteries, charging system and starting system. The students are acquainted with the operation, maintenance and repairs of all the above systems of an automobile.

DESIRABLE AWARENESS/SKILLS:

Fundamental knowledge of Engineering Graphics, Machine Drawing, Mathematics, Physics, Metallurgy, Strength of materials, Theory of Machines, Electrical and Electronics and I.C. Engines

COURSE OBJECTIVE:

The students should able to

1. Introduction to engineering analysis of the automobile components and its details
2. Application of engineering principles to automotive system working
3. Familiarization with modelling and analysis methods
4. Familiarization with the automotive and its terminology

COURSE OUTCOMES:

On completion of this course; student shall be able to:

1. Develop a rudimentary understanding of various the automobile components and their constructional details.
2. Understand various types of brakes.
3. Knowledge of various cooling and lubrication systems
4. Describe the fuel supply system for petrol engine and diesel engine
5. Understand working of storage batteries, charging system and starting system

RELEVANCE OF COS / POS AND STRENGTH OF CO- RELATION:

PO/CO	CO-1	CO-2	CO-3	CO-4	CO-5
PO-a	3	3	3	2	2
PO-b	3	2	2	2	2
PO-c	2	3	3	3	1
PO-d	3	3	3	3	1
PO-e	3	3	2	2	2
PO-f	3	3	3	3	3
PO-g	2	2	2	3	1
PO-h	3	3	3	2	2

1-Weakly correlated 2 – Moderately correlated 3 – Strongly correlated

COURSE CONTENTS:

Introduction to automobile components and their constructional details

Definition, components of an automobile, firing order, types of engines, number and arrangement of engine cylinders, constructional details of main parts of an automobile such as cylinder block, cylinder head, sump or oil pan, manifold, gaskets, cylinder, pistons, piston rings, connecting rod, piston pin, crankshaft, main bearings, valve and valve actuating mechanisms, mufflers

Brakes

Principle, requirements, brake efficiency and stopping distance, fading of brakes, wheel skidding, types of brakes, drum brakes, disc brakes, mechanical brakes, hydraulic brakes, brake fluid, electric brakes, servo brake systems, power brakes, vaccum brakes, air brakes, hand brake, brake drums, brake shoes, brake linings, disc brake pads, antilock brake system, inspection of brake system, adjustment of brakes, servicing disc brakes, state of the art, regerative brake system, electric-hydraulic combi brake, sensotronic brake control, Siemens VDO electronic wedge brake, carbon-ceramic brakes, brake system selection criteria, brake system trouble shooting

Cooling system and lubrication system

Necessity, methods, air cooling, water cooling types, components of water cooling system, such as radiator, pressures cap, thermostat, pump, fan, coolants, antifreeze solution, temperature gauges, cooling system trouble shooting, objectives of lubrication, requirements of lubricants, types of lubricants, viscosity rating, service rating, oil additives, effect of engine conditions on lubrication oil, critical lubrication conditions for automobile engines, automobile engine lubrication, systems of engine lubrication, oil strainers, oil pumps, oil filters, oil level indicators, oil pressure gauges, chassis lubrication, lubrication system service, lubrication system trouble shooting

Fuel supply system for petrol engine and diesel engine

Fuel supply system for petrol engine: Fuel supply systems, fuel tank, fuel pumps, fuel pump trouble shooting and service, air cleaners, simple carburettor, petro injection, components of petrol injection, fuel filters, fuel gauge, Bosch motronic gasoline system, DI- motronic sytem, supercharging and turbochargers, fuel supply system shooting, MPFI fuel injection, Electronic Fuel Injection

Fuel supply system for diesel engine: functions, fuel injection system, fuel filters, air cleaners, fuel feed pump, fuel injection pump, fuel injector, governor and their types, modern common rail fuel injection system, Bosch third generation CRS, supercharging, cold starting devices, trouble shooting of diesel engine starting system

Storage Batteries, Charging system and Starting system

Storage Batteries: function, types, lead acid battery, Battery capacity, Battery ratings, battery charging, battery testing, battery troubles, battery maintenance, jump starting, alkaline battery, zinc air battery, nickel-metal battery, lithium battery

Charging system: introduction, construction of D.C. generator, generator output control, generator faults and their diagnosis, alternator: principle, construction, tests, trouble shooting

Starting system: starting motor, starting drives types, Bendix drives, overrunning clutch drive, dyer drive, starting motor switches and control unit, electronic stator control, testing the starting system, starting system trouble shooting, integrated starter-generator

Text books:

1. Automotive Mechanics Principles and Practices, Joseph Heitner, 2nd Edition, 2013 onwards, Affiliated East-West Press Pvt. Ltd.
2. Automobile Mechanics, N. K. Giri, 1 st Edition, 2004 onwards, Khanna Publishers
3. Automobile Engineering, G. B. S Narang, 3 rd Edition, 2012 onwards, S. Chand and Company Ltd.
4. Automobile Engineering -Volume 2, Dr. Kirpal Singh, 13th Edition, 2013 onwards,

Standard Publishers and Distributors
5. Automobile Engineering, Anil Chhikara, 2nd Edition, 2002-3 onwards, Satya Prakashan
6. Automotive Engineering Fundamentals, Richard Stone, Jeffrey K. Ball, 2004, SAE International

Reference books:

1. Motor Vehicle, K. Newton and W. Seeds, T.K. Garrett, 13th Edition, 2001 onwards, Elsevier publications
2. Handbook of Automotive Engineering, Hans Hermann Braess, Ulrich Seiffen, 1 st Edition, 2005 onwards, SAE Publications
3. Automotive Mechanics, William H. Crouse, 10 th Edition, 2006 onwards Tata McGraw Hill Publishing House.

ME 453 (C) Elective-II
MACHINE TOOL DESIGN

Teaching Scheme: 03L+02P**, Total:** 05 **Credit :** 03
Evaluation Scheme: 15 ISE1+15 ISE2+10 ISA+ 60ESE **Total marks :** 100
Duration of ESE: 03 Hrs.

COURSE DESCRIPTION :

This course introduces undergraduate students to different parts of machines, failure criteria and conventional design procedures.

DESIRABLE AWARENESS/SKILLS:

A sound knowledge of Mathematics, Engineering Mechanics, SOM, TOM and Machine Drawing are requiring. basic knowledge of workshop practice, manufacturing process, gear design are requisite .

COURSE OBJECTIVES :

Students should be able to:

1. understand procedure of machine design and develop an ability to apply it for simple component design such as headstock driven system.
2. understand the different theories of failure and develop an ability to apply its knowledge for design of mechanical component and determine the resisting areas against failure
3. determine forces on transmission shaft and design of transmission shaft and speed reduction via gear trains and engagement system
4. determine the endurance strength and design of components subjected to fluctuating loads of machine tools components

COURSE OUTCOMES:

On completion of this course student should be able to:

1. Analyze the stresses and strains induced in a machine element. Design different components as column, guide ways, slide ways and gear box etc miscellaneous components .
2. design spindle speed stages along with gear teeth and other parameter and design with drawing gear box

RELEVANCE OF COS /POS AND STRENGTH OF CO-RELATION:

PO/CO	CO-1	CO-2
PO-b	3	2
PO-h	1	3
PO-j	3	2
PO-l	2	3

1-Weakly correlated 2 – Moderately correlated 3 – Strongly correlated

COURSE CONTENTS :

Introduction & Drives: Recent Trends in designing machine tools:

Classification of various machine tools General purpose, Special purpose, NC-CNC on the basis of kinematics. Considerations in designing drives, based on continuous on intermittent requirement of power. Type and selection of motor for the drive, regulation and range of speed based on preferred number series/ Geometric progression. Design of headstock gear box for spindle drive using ray diagram, structure diagram, nodal optimization while designing compact gearbox.

Steples Regulation & Elements of Machine Tools:

Electromechanical regulation of speeds, Friction, pressure and ball variators, P.I.V. drive (Kopp. Variator) Epicyclic drive etc. Design of beds, slideways, carriage, tables of lathes, milling machines based on force, frictional behavior and different types of lubrication system, used. Design of Power Screws – sliding as well as rolling friction, spindle units, and bearing, Preloaded supports.

Static & Dynamic Rigidity of Machine tools:-

Sources of Vibration, Chatter, Stability, Dynamics of Cutting Process Vis-a-Vis machine tool, Stick-slip phenomenon and methods of combating.

Control System:

Electrical Control: Push button control, directional control relays, thermal relays, electrical brakes, Control for reversing traverse and automation in feed mechanism, selective/pre-selective control, and adaptive control.

Hydraulic Control of shaper, miller and other machine. Power pack for lubrication system in hydrostatic drive.

NC - CNC Machine:

Introduction, Construction, Operation, Transducers of various type, CPU block diagram, CAD-CAM Systems interfacing, APT programming, Retrofitting & Design considerations for conversion. Open or closed loop for NC\CNC machine using stepper motor or DC motor, protective and safety devices. Flexible manufacturing System: Definition, Types, classification, equipment application – Auto Tool Changer – types, functional details, Modular Concept of Design.

Acceptance tests for machine tools:

Schlesinger‟s tests and Tobias‟s Stability Envelopes, Performance criteria of Machine Tools, Static & Dynamic tests, foundation of Machine tools etc.

Text books:

1. Machine Tool Design G. R. third edition Nagpal Khanna publication, New Delhi, 1999.
2. Design of Machine Tool‘’,D. K Pal, S. K. Basu, 4th Edition. Oxford IBH 2005, 204-0968.

Reference books:

1. Design Principles of Metal Cutting Machine Tools, F. Koenigsberger, The Macmillan Company New York 1964.
2. Principles of Machine Tool, Bhattacharya and S. G. Sen., New central book agency Calcutta, ISBN 81-7381-1555.
3. Machine Tool, N. S. Acherkan, Vol. I, II, III and IV, MIR publications.
4. Machine Tool Design, N. K. Mehta, Tata McGraw Hill, ISBN 0-07-451775-9.

ME 453 (D) Elective-II
PROCESS EQUIPMENT DESIGN

Teaching Scheme: 03L+02P**, Total:** 05 **Credit :** 03
Evaluation Scheme: 15 ISE1+15 ISE2+10 ISA+ 60ESE **Total marks :** 100
Duration of ESE: 03 Hrs.

COURSE DESCRIPTION :

To integrate the various courses such as Chemistry, Engineering Mechanism, Engineering Graphics, unit operation, Mechanics of solid , Material technology for a comprehension approach to design the process equipments.

DESIRABLE AWARENESS/SKILLS:

A sound knowledge of Mathematics, Engineering Mechanics, SOM, TOM and Machine Drawing are require.

COURSE OBJECTIVES :

Students should be able to:

1. develop skill design of simple element in direction of thermal phenomenon,
2. require the basic knowledge for installation of pressure vessels.
3. design vessel support, storage tanks for various fluids medium.
4. general design, drawing of Cyclone separator, centrifuges, thickeners and filtration equipments, agitated vessel, Jacketed and coil heated vessel.

COURSE OUTCOMES:

On completion of this course student should be able to:

1. Analyze the stresses and strains induced in a walls of vessel.
2. Design different components including riveted, bolted and welded joints and energy storing and releasing devices used under creeping, fatigue and thermal reactions..
3. Design and drawing the storage tanks support, skirts, brackets, saddles etc..

RELEVANCE OF COS /POS AND STRENGTH OF CO-RELATION:

PO/CO	CO-1	CO-2	CO-3
PO-b	2	2	1
PO-h	1	2	2
PO-j	3	3	3
PO-l	1	3	3

1-Weakly correlated 2 – Moderately correlated 3 – Strongly correlated

COURSE CONTENTS :

Revision of stresses and feasibility in thermal environment

Introduction: Revision of stress and strain in thick and thin cylinder and pressure vessel.

Design and drawing consideration for bolt, nut and screws, various welded and riveted joint, nozzle reinforcements, pipe fittings.

Criteria in vessel design, excessive elastic deformation, plastic instability, brittle, rupture, creep.

General criteria for design vessels

General design and drawing consideration of vessel subjected to internal pressure, construction feature, code, design of shell, types of heads, and thickness of heads.

Design of storage tanks

Design of storage vessel, storage of non volatile liquids and gases, code for storage, bottom and shell design, Design of vessel under external pressure, vacuum stress analysis, design and drawing consideration of pressure vessel support such as bracket saddle, skirts, etc..

Stiffener design and piping

Introduction to Storage and vessel stiffness, various forms of stiffeners and its significance, design of circumferential stiffeners, design of covers, pipes and tubing.

Pressure vessel allied accessories and mounting design

Fundamental principles, equation, general design and drawing consideration of following

Cyclone separator,

Centrifuges,

Thickeners,

Filtration equipments,

Crystallizer,

Agitated vessel,

Jacketed and coil heated vessels.

High pressure vessel design

Design of High Pressure Vessel, autoclave Support for vessel, types, leg support skirt, support design.

Text Book:

1. Machine design R.S. Khurmi, 50th edition, S. Chand publication 2016, Delhi
2. Process Equipment design M. V. Joshi, Mahajan, 8th edition, Mcmillan, India, ltd, Delhi.
3. Process design of Equipments S. D. Dawande, Cntral Techno Publication Nagpur, 3rd edition, 2000, Nagpur.

Reference Book :

1. Process Equipment Design by N.V .Joshi
2. Process equipment design by L. E. Browr, E. H. Yovng
3. Introduction to process Equipment Design by B. C. Bhattacharya.
4. Indian standard specification IS-803, 1962; IS -4072,1967; IS -2825, 1969 Indian standard New Delhi.
5. Unit operation of chemical Engineering, second edition,Mc Graw Hill 2001 Delhi.

ME 454 (A) Elective-III
ADVANCE MACHINE DESIGN

Teaching Scheme: 03L+02P**, Total:** 05 **Credit :** 03
Evaluation Scheme: 15 ISE1+15 ISE2+10 ISA+ 60ESE **Total marks :** 100
Duration of ESE: 03 Hrs.

COURSE DESCRIPTION :

This course introduces undergraduate students to different parts of machines, failure criteria and conventional design procedures.

DESIRABLE AWARENESS/SKILLS:

A sound knowledge of Mathematics, Engineering Mechanics, SOM, TOM and Machine Drawing are require.

COURSE OBJECTIVES

Students should be able to:

1. understand procedure of machine design and develop an ability to apply it for simple component design.
2. understand the different theories of failure and develop an ability to apply its knowledge for design of mechanical component and determine the resisting areas against failure.
3. Consider cost, reliability and durability factors
4. Make design sound and safe and maintenance free or easy to maintenance.

COURSE OUTCOMES:

On completion of this course student should be able to:

1. Analyze the stresses and strains induced in a machine element.
2. Design and plan the product development
3. Understand and identify the threats in upcoming conventional and computerized design flaws through customers.
4. Design a machine component using theories of failure.

RELEVANCE OF COS /POS AND STRENGTH OF CO-RELATION:

PO/CO	CO-1	CO-2	CO-3	CO-4
PO-b	2	2	1	2
PO-h	1	2	2	1
PO-j	3	3	3	1
PO-l	1	3	3	3

1-Weakly correlated 2 – Moderately correlated 3 – Strongly correlated

COURSE CONTENTS

Development processes and organizations, Product Planning

General design procedure for design problems, design concepts, product design and development, Product design specifications, Product life cycle, Protection of intellectual property, Bench marking, Brainstorming, Ethics in Engineering design, Whistle blowing.

Need Identification and problem definition, product specification, concept generation

Design based on - Fatigue, Fracture, Creep criteria, safe life v/s fails safe design
and selection, evaluation, creativity methods, Concept testing. Dynamic design of Mechanical equipments: Modelling of machine tools, Aircraft and Automobiles etc. for determining dynamic characteristics and extraction of Modal parameters for dynamic design.

Design for manufacture, assembly, maintenance, casting, forging,

Design for manufacturing including assembly aspects & other aspects, reliability based design of mechanical components.

Design for Reliability, strength based reliability, parallel and series systems, robust design,.

Recent developments in pressure vessel design, testing of pressure vessels as per standards. Computer aided design of pressure vessels.

Industrial design:

Design for Emotion and experience, Introduction to retrofit and Eco-design, Human behavior in design
Rotating disc and rotating cylinder:- Disc with uniform thickness – disc for uniform strength – stresses in rotating cylinders with and without internal pressure.
Thermal stress, creep and stress rupture; Dynamic and fatigue behaviour.

Rapid Prototyping.

Friction theories, wear & types of wear, Lubrication, different modes of lubrication -hydrodynamic, hydrostatic & Elasto-Hydrodynamic, porous bearings, determination of static load capacity of bearing (Stribek's equation), bearing design & testing. Lubrication problems at certain extreme environmental conditions pressure, temperature & vacuum.

Material and component advance design & identifying

Recent trends in materials handling equipment design, basic principles of design, main girder design, structure analysis , loading patterns, service factors & environmental conditions, testing as per BIS, etc.
Advances in gear design, gear materials, corrective gear design, gear rating calculation as per BIS, etc
Quality Function Deployment – Concurrent engineering.

Text Book:

1. Machine Design – An Integrated Approach by Robert L Norton, 10 th edition Pearson Education.
2. Mechanical System Design by Farazdak Haidery, 2000, nirali publication , pune, india.
3. Material handling equipment by P.Rudenko, MIR Publication.
4. Handbook of Gear design by G.M. Maitra, vol. –I & II.

References Book

1. Engineering Design by George E. Dieter, McGraw Hill.
2. Mechanical analysis & design by Burr and Cheatham.
3. Engineering Design by George E. Dieter, McGraw Hill.
4. Simulation, modeling and analysis", Averill M. Law and W. David Kelton " McGraw Hill Book Company, 1991.
5. Engineering Design–A Systematic Approach – Pahl, G.and W. Beitz, Springer, 2nd Ed., 1996.
6. Product Design and development Karl T. Ulrich, Steven Eppinger.

ME 454 (B) Elective-III
Mechanical Vibrations

Teaching Scheme: 03L+02P**, Total:** 05 **Credit:** 03
Evaluation Scheme: 15 ISE1+15 ISE2+10 ISA+ 60ESE **Total marks:** 100
Duration of ESE : 3 Hrs

COURSE DESCRIPTION:

This course introduces undergraduate students to Mechanical Vibrations. This course deals with the study of vibrations in mechanical systems which is concerned with the oscillatory motions of bodies and the forces associated with them. This course aims to understand the nature and behaviour of dynamic engineering systems and the capability of applying the knowledge of mathematics, science, and engineering to solve engineering vibration problems.

DESIRABLE AWARENESS/SKILLS:

Mathematics (Calculus) at First year level and strength of Materials, Engineering Mechanics, Theory of Machines at Second year Level.

COURSE OBJECTIVES:

The students should able to

1. understand and appreciate the importance of vibrations in mechanical design of machine parts that operate in vibratory conditions.
2. make free and forced (harmonic, periodic) vibration analysis of single and multi-degree of freedom linear systems.

COURSE OUTCOMES:

On the successful completion of this course; student shall be able to

1. model undamped and damped mechanical systems and structures.
2. model free and harmonically forced vibrations
3. model single- and multi-degree of freedom systems.
4. Understand Forced Motion due to harmonic loading and rotating unbalance.

RELEVANCE OF COS /POS AND STRENGTH OF CO-RELATION:

PO/CO	CO-1	CO-2	CO-3	CO-4
PO-b	3	3	3	3
PO-c	3	3	3	3
PO-e	3	3	3	3
PO-g	2	2	2	2
PO-k	2	2	2	2
PO-l	3	3	2	2

1-Weakly correlated 2 – Moderately correlated 3 – Strongly correlated

COURSE CONTENTS

Fundamental of Vibrations & Undamped Free Vibrations

Fundamental of Vibrations: - Introduction, Definitions, Vector method of representing harmonic motions, Addition of two simple harmonic motions of
the same frequency, Beat phenomenon.
Complex method of representing harmonic vibrations, Work done by a harmonic force on a harmonic motion.

Undamped Free Vibrations of Single Degree of Freedom Systems: - Introduction, Derivation of differential equation, Solution of differential equation, Torsional vibrations, Equivalent stiffness of spring combinations, Energy method.

Damped Free Vibrations of Single Degree of Freedom Systems: - Introduction, Different types of damping, Free vibrations with viscous damping, Logarithmic decrement. Viscous dampers, Dry friction or coulomb damping, Solid or structural damping, Slip or interfacial damping.

Forced Vibrations of Single Degree of Freedom Systems:- Introduction, Forced vibrations with constant harmonic excitation, Forced vibrations with rotating and reciprocating unbalance, Forced vibrations due to excitation of support. Energy dissipated by damping, Forced vibrations with coulomb damping, Forced vibrations with structural damping, Vibration isolation and transmissibility.

Two Degree of Freedom Systems

Introduction, Principal modes of vibration, other cases of simple two degree of freedom systems, combined rectilinear and angular modes.
Undamped forced vibrations with harmonic excitation, Vibration absorbers.
Critical speed of shaft- Introduction, critical speed of light shaft having single disc without damping, critical speed of light shaft having single disc with damping.

Multi Degree of Freedom Systems Exact Analysis: - Introduction, Free vibrations equations of motion, Influence coefficients, Generalized coordinates.
and coordinate coupling. Natural frequencies and mode shapes, Forced vibrations by Newtons second law of motion, Torsion vibrations of multi-rotor systems.

Multi Degree of Freedom Systems Numerical Methods: - Introduction,
Rayleigh's method, Dunkerley's method, Stodola's method.

Continuous Systems: - Vibrations of strings, Longitudinal vibrations of bars, Torsional vibrations of circular shafts, Lateral vibrations of beams.

Non-Linear Vibrations: - Introduction, Examples of non-linear systems, Phase plane, Undamped free vibration with nonlinear spring forces.
Perturbation method, Forced vibration with non-linear spring forces, Self excited vibrations.

Text Book

1.G.K. Grover "Mechanical Vibrations" New Chand & Bros Roorkee (U.P.)
2. V. P. Singh "Mechanical Vibrations " Dhanpat Rai & Co. (P) Ltd., Delhi.
3. Singiresu S. Rao "Mechanical Vibrations "Pearson Education Ptd. Ltd., Delhi.

Reference Books

1. Dilip Kumar Adhwarjee “Theory and Applications of Mechanical Vibrations Laxmi Publications (p) Ltd., New Delhi.
2. Leonard Meirovitch “Element of Vibration Analysis” Tata McGraw-Hill Publishing Company Limited, New Delhi
3. S. Graham Kelly “ Schaum’sOut lines Mechanical Vibrations “ Tata McGraw-Hill Publishing Company Limited, New Delhi.
4. Thompson,” Theory of Vibration with Application”, Pearson Education.
5. B. H. Tongue,” Principles of Vibration”, 2/ed. Oxford University Press, New Delhi.
6. Sadhu singh“ Mechanical vibration & Noise control” published by Khanna Publisher New Delhi.

ME 454 (C) Elective-III
TRIBOLOGY

Teaching Scheme: 03L+ 02PR**, Total:** 05 **Credit:** 03
Evaluation Scheme: 15 ISE1 + 15 ISE2 + 10 ISA + 60 ESE **Total Marks:** 100
Duration of ESE: 3 hours

COURSE DESCRIPTION:

The course aim of imparting the knowledge of Tribology. The background required includes knowledge of mathematics, chemistry, engineering materials, and fluid mechanics. The objective of the course is to understand the tribological concept, bearing design and its application, lubrication practices

DESIRABLE AWARENESS/SKILLS:

Fundamental Knowledge of Physics, Chemistry, Engineering Math, Fluid Mechanics, Machine Design and Engineering materials.

COURSE OBJECTIVE:

The students should able to

1. To know about properties of lubricants, modes of lubrication, additives etc.
2. To Select suitable/proper grade lubricant for specific application.
3. To Apply the basic theories of friction, wear and lubrications about frictional behaviour commonly encountered sliding surfaces.
4. To suggest an explanation to the cause of tribological failures.
5. To design bearing, friction, wear test rig for laboratory purposes.

COURSE OUTCOMES:

On completion of this course student should be able to:

1. Have a clear overall picture about the basics of tribology and related sciences, theoretical background about processes in tribological system, mechanisms and forms of interaction of friction surfaces.
2. Have a mastery of the friction/lubrication mechanisms and know how to apply them to the practical engineering problem.
3. To enhance students awareness of tribological issues in the design of machine components, such as rolling element bearings, journal bearings, thrust bearings, seals and braking systems.

RELEVANCE OF COS / POS AND STRENGTH OF CO RELATION:

PO/CO	CO-1	CO-2	CO-3
PO-a	3	2	1
PO-b	3	1	2
PO-g	1	3	2
PO-e	2	1	3

1-Weakly correlated 2–Moderately correlated 3–Strongly correlated

COURSE CONTENT:

Introduction to Tribology, tribology in design, tribology in industry, Lubricants Properties-physical and chemical, Types of additives, extreme pressure lubricants, Lubrication-introduction, basic modes of lubrication, Tribology of sliding contact bearings and Rolling contact bearings.

Wear, Friction and Lubrication Wear- Mechanism of wear, types of wear, measurement of wear (wear testing and wear debris analysis). Theory of wear, factor affecting on wear rate. Friction: Sources of friction, Influence of roughness of friction, coefficient of friction, Friction of metals, kinds and measurements of frictions, stick slip oscillation (Vibration) and its elimination surfaces, static and kinematics coefficient of friction, Lubrication: Types of lubricants, lubricant coating, lubrication mechanism, squeeze film, hydrodynamic, elasto-hydrodynamic lubrication

Hydrodynamic Bearings: Mechanism of pressure development in oil film in hydrodynamic lubrication, Solution of Generalized Reynold's equation, Infinitely long journal bearing, Infinitely short journal bearing, thrust bearing, Sommerfeld number, Raimondi and Boyd method, Temperature rise, Parameters of bearing design-Length to diameter ratio, Unit bearing pressure, Optimal Radial clearance and minimum oil film thickness.

Hydrostatic Bearings: Basic concept, advantages and limitations, Viscous flow through rectangular slot, Load carrying capacity and flow requirement of hydrostatic step bearing, energy losses (Numerical Treatment). Hydrostatic squeeze film: Introduction, circular and rectangular plates approaching a plane.

Gas Lubrication: Introduction, Reynolds equation for gas lubrication, self-acting gas bearing, Merits and demerits of gas lubrication, Applications, Lubrication in metal working: Rolling, Forging, Drawing and extrusion Bearing Materials and bearing constructions. Oil seals and shields, Gaskets.

Text Book

1. A Text Book of "Tribology" by Hg Phakatkar, Rr Ghorpade, Second Revised Edition, Nirali Prakashan, Pune, Aug 2011.
2. A Text Book of "Tribology" by R.B.Patil, First Edition, Tech-Max Publications, Pune, Aug 2009
3. A Text Book of "Introduction to Tribology" by Bharat Bhushan, Second Edition, John Wiley and Sons Publication, NY, 2013.
4. A Text book of "Design of Machine Elements by V.B.Bhandari, Fourth Edition, Tata-McGraw Hill Publication Co. Ltd., Aug 2016

Reference Books

1. "Theory and Practice of Lubrication for Engineers", by Fuller D. D., Vol.1, Issue 4, by John Wiley and Sons Publication. 1984.
2. "The Tribology Hand Book" by Neale M. J, Second Edition, Butterworth-Heinemann, 1996.
3. "Handbook of Tribology" by Bharat Bhushan. First Edition, Krieger Publishing Company,1997.

ME 454 (D) Elective-III
COMPUTATIONAL FLUID DYNAMICS

Teaching Scheme: 03L+02P**, Total:** 05 **Credits:** 03
Evaluation Scheme: 15 ISE1 + 15 ISE2 + 10 ISA + 60 ESE **Total Marks:** 100
Duration of ESE: 03 Hrs

COURSE DESCRIPTION:

Computational fluid dynamics (CFD) has become an essential tool in analysis and design of thermal and fluid flow systems in wide range of industries. Few prominent areas of applications of CFD include meteorology, transport systems (aerospace, automobile, high speed trains), energy systems, environment, electronics, bio-medical (design of life support and drug delivery systems), etc.

The correct use of CFD as a design analysis or diagnostic tool requires a thorough understanding of underlying physics, mathematical modeling and numerical techniques. The user must be fully aware of the properties and limitations of the numerical techniques incorporated in CFD software. This course aims to provide precisely these insights of CFD.

DESIRABLE AWARENESS/SKILLS:

Knowledge of Higher Engineering Mathematics, heat transfer and Fluid Mechanics

COURSE OBJECTIVE:

The students should able to

1. To provide the students with sufficient background to understand the mathematical representation of the governing equations of fluid flow and heat transfer.
2. To solve one and two-dimensional ordinary and partial differential equations using traditional CFD tools.
3. To express derivatives and differential equations through discretization techniques.
4. To understand the general transformation equations for grid generation.
5. To apply explicit, implicit and semi-implicit methods of finite differencing and solve fluid flow field using some popular CFD techniques.

COURSE OUTCOMES:

On completion of this course student should be able to:

1. Derive the basic governing equations applied for fluid flow problems.
2. Possess the knowledge of CFD techniques, basic aspects of discretization and grid generation.
3. Solve fluid flow fields using CFD methods.
4. Model fluid flow problems and heat transfer.

RELEVANCE OF COS / POS AND STRENGTH OF CO- RELATION:

PO/CO	CO-1	CO-2	CO-3	CO-4
PO-a	3	2	2	2
PO-c	2	3	1	3
PO-d	2	1	1	2
PO-e	2	2	3	3

1-Weakly correlated 2 – Moderately correlated 3 – Strongly correlated

COURSE CONTENT

Introduction and Governing Equations

Introduction to Computational Fluid Dynamics, CFD Applications, Governing equations of fluid dynamics – Continuity, Momentum and energy, Generic integral form for governing equations - Initial and Boundary conditions, Governing equations for boundary layers, Classification of partial differential equations – Hyperbolic, Parabolic, Elliptic and Mixed types - Applications and relevance.

Discretization

Basic aspects of discretization, Discretization techniques, Finite difference, Finite volume and Finite Element Method, Comparison of discretization by the three methods, Introduction to Finite differences, Transient one-dimensional and two-dimensional conduction, Explicit, Implicit, Crank-Nicolson, ADI scheme, Stability criterion, Difference equations - Numerical errors - Grid independence test - Optimum step size.

Grid Generation

Grid generation, General transformation of the equations, Form of the governing equations suitable for CFD, Algebraic and Elliptic Methods, Adaptive grids, Unstructured grid generation, Modern developments in grid generation.

Finite Volume Method

Finite volume methods, different types of finite volume grids, approximation of surface and volume integrals, interpolation methods, central, upwind and hybrid formulations and comparison for convection diffusion problems, one and two dimensional, steady and unsteady, Advection schemes, Pressure velocity coupling, SIMPLE family of algorithms

Viscous Incompressible Flow

Introduction, Governing equations, Incompressible flow computation, Stream function vorticity approach, MAC Method, solution scheme, Determination of pressure for viscous flow, Two dimensional incompressible viscous flow, estimate on of discretization error, applications to curvilinear geometries, derivation of surface pressure & drag.

Text Books:

1) Computational Fluid Flow and Heat Transfer, Muralidhar. K, and Sundararajan.T, Second Edition, 2008, Narosa Publishing House, New Delhi.
2) Computational Fluid dynamics, Anderson J.D, 2010, McGraw Hill International, New York.
3) Numerical Heat Transfer and Fluid Flow, Suhas.V. Patankar, 2009, Hemisphere Publishing Corporation.
4)

References Books:

1) An Introduction to computational fluid dynamics: The finite volume method, Versteeg H.K., and Malalasekera W, 2007, Longman Scientific & Technical.
2) Computational Fluid Dynamics: The Basics with Applications, John David Anderson, First edition, 1995, McGraw Hill Education, New York.
3) Computer simulation of fluid flow and heat transfer, Ghoshdasdidar P. S, 1998, Tata McGraw Hill Publishing Company Ltd.
4) Introduction to Computational Fluid Dynamics, Date A. W, First edition, 2005, Cambridge University Press.

ME 455- FINITE ELEMENT METHOD LAB

Teaching Scheme: 02P, **Total:** 02 **Credit:** 01
Evaluation Scheme: 25 ICA+25 ESE **Total Marks: 5**0

Internal continuous assessment performance shall be based on ME 451 and consist of following Assignments and Projects

1. Term work shall consist of ONE analysis project. The analysis project shall consist of analysis of I-cantilever beam, Flow in a system of pipes, Trusses, Modal Analysis of Spring-Mass System, Modal Analysis of continuous System, Thermal analysis of any component, Stress strain analysis of any component, Stress strain analysis of any component.
2. Total five assignments (One on each unit – only Numerical)

Guide lines for ICA:

Internal continuous assessment should support for regular performance of practical and its regular assessment with proper understanding principle of practicals completed.

Guide lines for ESE:

Oral will be based on content of syllabus and practical.

ME 456(A) Elective – II
POWER PLANT ENGINEERING LAB

Teaching Scheme: 02P, **Total:** 02 **Credit:** 01
Evaluation Scheme: 25ICA + 25 ESE **Total Marks:** 50

Minimum Eight experiments shall be performed to cover entire curriculum of course.
List of Experiments:

1. Study of Wind Turbines.
2. Study of steam turbines systems.
3. Study of hydraulic turbines
4. Visit to Solar Power Plant.
5. Visit to Wind Power Plant.
6. Visit to hydraulic power plant.
7. Visit to Gas Power Plant
8. Visit to Steam Power Plant
9. Visit to Nuclear Power Plant.

Guide lines for ICA:
Internal Continuous Assessment shall support for regular performance of practical and its regular assessment. In addition; it shall be based on knowledge/skill acquired and record submitted by student (Journal) based on practical performed by him/her. The performance shall be assessed experiment wise using internal continuous assessment format (S 10).

Guide Lines for ESE:
The End Semester Exam for this course shall be based on oral examination which covers content of syllabus and practical conducted, to judge the skills acquired by student. It shall be evaluated by two examiners out of which one examiner shall be out of institute.

ME 456 (B) Elective-II
AUTOMOBILE ENGINEERING – II LAB

Teaching Scheme: 02 P, Total: 02 **Credit:** 01
Evaluation Scheme: 25 ICA + 25 ESE **Total Marks:** 50

Minimum eight experiments shall be performed to cover entire curriculum of course ME 456. The list given below is just a guideline.

List of experiments:

1. Study of various components of an automobile
2. Study of different types of brakes and brake trouble shooting.
3. Study of various types of clutches, clutch operation, clutch components and clutch trouble shooting.
4. Study of cooling systems and cooling systems trouble shooting.
5. Study of lubrication systems and lubrication systems trouble shooting.
6. Study of fuel supply system for petrol engine and its trouble shooting.
7. Study of fuel supply system for diesel engine and its trouble shooting.
8. Study of various types of storage batteries, battery ratings, battery charging, battery testing, battery troubles, battery maintenance.
9. Study of construction of D.C. generator, generator output control, generator faults and their diagnosis, alternator and its trouble shooting
10. Study of starting drives types, testing the starting system, starting system trouble shooting.

Guide lines for ICA: Internal Continuous Assessment shall support for regular performance of practical and its regular assessment. In addition; it shall be based on knowledge/skill acquired and record submitted by student (Journal and sheet) based on practical performed by him/her. The performance shall be assessed experiment wise using internal continuous assessment format (S 10).

Guide Lines for ESE: The End Semester Exam for this course shall be based on oral examination which covers content of syllabus and practical conducted, to judge the skills acquired by student. It shall be evaluated by two examiners out of which one examiner shall be out of institute.

ME 456 (C) Elective-II
MACHINE TOOL DESIGN LAB

Teaching Scheme: 02 P, **Total:** 02 **Credit:** 01
Evaluation Scheme: 25 ICA + 25 ESE **Total Marks:** 50

Internal continuous assessment shall consist of minimum five assignments and covers all topic of theory course and two sheets - full imperial drawing sheet on topic gear box design from theory course ME 453 (C).

- Assignment and drawing sheets with report shall be bunched in journal of ICA

-List of Assignments:

1. Assignment on Recent Trends in designing machine tools:

2. Assignment on Steppless Regulation & Elements of Machine Tools:

3. Assignment on Static & Dynamic Rigidity of Machine tools:-

4. Assignment on Control System:

5. Assignment on NC - CNC Machine:

6. Assignment on Acceptance tests for machine tools:

- List of sheets

Two full imperial drawing sheet shall consist of problem on designing of gear box along with its analysis of all parameters require to design.

Guide lines for ICA: Internal Continuous Assessment shall support for regular performance of practical and its regular assessment. In addition; it shall be based on knowledge/skill acquired and record submitted by student (Journal and sheet) based on practical performed by him/her. The performance shall be assessed experiment wise using internal continuous assessment format (S 10).

Guide Lines for ESE: The End Semester Exam for this course shall be based on oral examination which covers content of syllabus and ICA journal, to judge the skills acquired by student. It shall be evaluated by two examiners out of which one examiner shall be out of institute

ME 456 (D) Elective-II
PROCESS EQUIPMENT DESIGN LAB

Teaching Scheme: 02 P, **Total:** 02 **Credit:** 01
Evaluation Scheme: 25 ICA + 25 ESE **Total Marks:** 50

Internal continuous assessment shall consist of Maximum Five Assignment and three sheets shall be performed to cover entire curriculum of course ME 456(D).

List of Assignments:

1. Assignment on stress and strain in thick and thin cylinder and pressure vessel. (With numerical)

2. Assignment Criteria in vessel design, excessive elastic deformation, plastic instability, brittle, rupture, creep

3. Assignment on Design of pressure vessel, internal pressure, construction feature, code, design of shell, types of heads, and thickness of heads. (With numerical)

4. Assignment on Design of storage vessel, storage of non volatile liquids and gases, code for storage, bottom and shell design, Design of vessel under external pressure, vacuum stress analysis,
Stiffness, design of circumferential stiffeners, design of covers, pipes and tubing (might be including numerical)

5. Assignment on Design of High Pressure Vessel, autoclave Support for vessel, types, leg support skirt, support design.

List of Sheets:-

-Three sheets shall be on design of pressure vessel of different parameters along with it analysis report and summery on paper shall be submit in Journal of ICA. Use full imperial sheets for completing above task.

Guide lines for ICA:

Internal Continuous Assessment shall support for regular performance of practical and its regular assessment. In addition; it shall be based on knowledge/skill acquired and record submitted by student (Journal and sheet) based on practical performed by him/her. The performance shall be assessed experiment wise using internal continuous assessment format (S 10).

Guide Lines for ESE:

The End Semester Exam for this course shall be based on oral examination which covers content of syllabus and practical conducted, to judge the skills acquired by student.

ME 457 (A) Elective-III
ADVANCE MACHINE DESIGN LAB

Teaching Scheme: 02 P, **Total:** 02 **Credit:** 01
Evaluation Scheme: 25 ICA + 25 ESE **Total Marks:** 50

Internal continuous assessment shall consist of Minimum six and three case studies of any product design experiments shall be performed to cover entire curriculum of course ME 454 (D).

List of Assignments:

1. Assignment on Development processes and organizations, Product Planning
2. Assignment on Need Identification and problem definition, product specification, concept generation and selection, evaluation, creativity methods, Concept testing
3. Assignment on Design for manufacture, assembly, maintenance, casting, forging,
4. Assignment on Design for Reliability, strength based reliability, parallel and series systems, robust design,.
5. Assignment on Industrial design: Design for Emotion and experience, Introduction to Retrofit and Eco design, Human behavior in design
6. Assignment on Rapid Prototyping.

List of case study:

1. Two case study report shall prepare on product design and its development of any Components and bunched along with journal of ICA
2. One case study of product development from designing shall be on forged or casted Parts.

Guide lines for ICA:

Internal Continuous Assessment shall support for regular performance of practical and its regular assessment. In addition; it shall be based on knowledge/skill acquired and record submitted by student (Journal) based on practical performed by him/her. The performance shall be assessed experiment wise using internal continuous assessment format (S 10).

Guide Lines for ESE:

The End Semester Exam for this course shall be based on oral examination which covers content of syllabus and practical conducted, to judge the skills acquired by student. It shall be evaluated by two examiners out of which one examiner shall be out of institute

ME 457 (B) MECHANICAL VIBRATION LAB

Teaching Scheme: 02PR, **Total**: 02 **Credit** : 01
Evaluation Scheme: 25 ICA+25 ESE **Total Marks** : 50

Minimum six experiments shall be performed and five assignments should be completed.
List of Experiments:

1) To study the torsional vibrations of single rotor system.
2) To study the torsional vibrations of two rotor system.
3) To study damped torsional vibrations of single rotor system.
4) To study undamped free vibrations of a spring.
5) To study the natural vibrations of a spring mass system.
6) To study forced damped vibrations of a spring mass system.
7) To study the forced damped vibrations of simply supported beam.
8) To determine critical speed of a single rotor system.

Guide lines for ICA:
Internal continuous assessment should support for regular performance of practical and its regular assessment with proper understanding principle of practices completed.
Guide Lines for ESE:
Oral will be based on content of syllabus and practical.

ME 457 (C) Elective-III
TRIBOLGY LAB

Teaching Scheme: 02P**, Total:** 02 **Credit:**01
Evaluation Scheme: 25ICA + 25ESE **Total Marks:** 50

Minimum five experiments and three assignments shall be performed to cover entire curriculum of course ME457 C.

1. Study/Demonstration on Journal Bearing apparatus.
2. Study/Demonstration on tilting pad thrust bearing apparatus.
3. Study/Demonstration on Brake line friction test rig.
4. Practical using Pin on disc test rig.
5. Friction in Journal Bearing.

Note: 03 assignment include in the course based on curriculum of this course.

Guidelines for ICA:
Internal Continuous Assessment shall support for regular performance of practical and its regular assessment. In addition; it shall be based on knowledge/skill acquired and record submitted by student (Journal and sheet) based on practical performed by him/her. The performance shall be assessed experiment wise using internal continuous assessment format (S 10)

Guidelines for ESE:
Oral will be based on content of syllabus and practical.

ME 457 (D) Elective-III
COMPUTATIONAL FLUID DYNAMICS LAB

Teaching Scheme: 02 P, **Total:** 02 **Credits:** 01
Evaluation Scheme: 25 ICA + 25 ESE **Total Marks:** 50

Minimum Eight practical shall be performed to cover entire curriculum of course ME 457. The list given below is just a guideline.

List of experiments:

1. Study of ANSYS Fluent & Overview of the CFD Process
2. 3 –D model of Simple pipe by using ANSYS Fluent
3. 2 –D model of Elbow by using ANSYS Fluent
4. Fluid Flow and Heat Transfer in a Mixing Tee using ANSYS Fluent
5. Mixing tank model by using ANSYS Fluent
6. 3 –D model of Catalytic Convertor by using ANSYS Fluent
7. 2 –D model of nozzle by using ANSYS Fluent
8. 2 –D model of conical combustion chamber by using ANSYS Fluent
9. Determine the turbulence of flow by using Reynolds number in fluent.
10. Automotive External Aero using ANSYS Meshing

Guide lines for ICA:

Internal Continuous Assessment shall support for regular performance of practical and its regular assessment. In addition; it shall be based on knowledge/skill acquired and record submitted by student (Journal and sheet) based on practical performed by him/her. The performance shall be assessed experiment wise using internal continuous assessment format **(S 10)**.

Guide Lines for ESE:

The End Semester Exam for this course shall be based on oral examination which covers content of syllabus and practical conducted, to judge the skills acquired by student. It shall be evaluated by two examiners out of which one examiner shall be out of institute.

ME 458 PROJECT PHASE –II

Teaching Scheme: 02P, **Total:** 02 **Credit:** 04
Evaluation Scheme: 50ICA+50 ESE **Total Marks:** 100

COURSE DESCRIPTION:

The Project Phase – I is one of the most important single piece of work in the degree programme. It is introduced in curriculum to put into practice some of the techniques that have been taught to students in earlier years. It also provides the opportunity to students to demonstrate independence and originality, to plan and organise a large project over a long period. The mini-project topic should be selected to ensure the satisfaction of the need to establish a direct link between the techniques they learnt and productivity. Thus it should reduce the gap between the world of work and the world of study.

DESIRABLE AWARENESS/SKILLS:

Knowledge of concepts, principles and techniques studied in all earlier courses.

COURSE OBJECTIVES:

The students should able to

1. to develop ability to synthesize knowledge and skills previously gained and to put some of them into practice.
2. to make students capable to select from different methodologies, methods and forms of analysis studied to produce a suitable system or sub-system.
3. to inculcate ability to present the findings of their technical solution in a written report.
4. to plan and organise a large project over a long period.

COURSE OUTCOME:

On successful completion of this course students shall

1. be able to apply the knowledge and skills previously gained into practice.
2. take appropriate decision w.r.t. various parameters related to production of a system or sub-system.
3. demonstrate the leadership quality along with ability to work in a group.
4. prove the ability to present the findings in a written report or oral presentation.

GUIDELINES FOR REPORT WRITING

for

B. E. and M. E.

(Dissertation, Project & Seminar Report)

Applicable From Academic Year 2012 - 13

GOVERNMENT COLLEGE OF ENGINEERING, JALGAON

Asian Highway No - 46, Jalgaon – 425002 (M.S.).

Phone No.0257- 2281522 Fax No.0257- 2281319

Email-princoej@rediffmail.com Web- www.gcoej.ac.in

CONTENTS

GUIDELINES FOR PROJECT/DISSERTATION REPORT WRITING
(B.E./ M.E.)

1.0 PREAMBLE: The content and the way of presentation of the Project/Dissertation report shows the efforts taken by the candidate(s) for his/her work. Therefore, proper attention shall be paid to the content of Project/Dissertation report which is being submitted in partial fulfillment of the requirements of the respective degree and it is imperative that a standard format be prescribed for the report. This document provides guidelines and standard format for seminar/project/dissertation report writing of UG/PG programs and it may be referred as report writing guide. Some material in this document may be of use in the preparation of any technical report.

2.0 ORGANISATION OF THE REPORT: The report shall be presented in number of chapters starting with introduction and ending with conclusion. Each of the chapters should have precise title reflecting the contents of that chapter. A chapter can be divided and subdivided into sections and subsections so as to present the content discretely and with due emphasis. In addition to main material of the report; preliminaries, references, appendices etc should be included in the report.

2.1. Sequence of Contents: The material should be placed and bound in following order:

i) Preliminaries: The following information should be furnished in the given sequence.

Top Sheet of transparent plastic
Title page
Certificate
Declaration
Acknowledgement
Abstract
Table of Contents
List of Figures
List of Tables
Nomenclature
Acronyms if any

ii) The Chapters (Main material):

It shall be presented in number of chapters starting with introduction and ending with conclusion as explained in section 4.

iii) Appendices:

iv) References:

v) Publications:

3.0 PRELIMINARIES:

3.1. Title Page: It is a first page of report. Try to find a title that clearly describes the work you have done and be as precise as possible. Mention Dissertation/ Project / Seminar title your name, guide's (and co-guide's) name, name of the department (i.e. Electronics and Telecommunication Engineering etc), name of the institute, place, month and year of the submission of report. .

3.2. Abstract: Summarize the main points of the report on a separate page. Persons interested in the report after reading the title should be able to judge from the abstract whether the report is really interesting for them. So, briefly formulate the problem that has been defined / investigated, the solutions derived, the results that have been achieved, and your conclusions. The abstract should not occupy more than one page (about 150 to 200 words). It must contain the context/ relevance of the problem at hand, a description of what was done and a gist of the significant observations/ results. It's noteworthy that the abstract shall be prepared after project work is over and report is completed in all respect. This page should precede the ToC page.

3.3 Certificate and Declaration: Both pages shall be in the unique format provided with this guide and duly signed by student, guide and all the authorities with date.

3.4 Acknowledgement: Please keep this brief and resist the temptation of writing flowery

prose. Do include all those who helped you, e.g. other faculty / staff you consulted, colleagues who assisted etc. Acknowledgement shall be included only in the final report and not in phase I or phase II as the case may be.

3.5 Table of Contents (ToC): Refer page no 11

- It should list items in the following order.

- Certificate (before T`oC)
- Declaration (before T`oC)
- Acknowledgement (before ToC)
- Abstract (before ToC)
- List of figures (1.1, 1.2, 1.3.., 2.1, 2.2, .. etc.) (after ToC)
- List of tables (1.1, 1.2, 1.3.., 2.1, 2.2, .. etc.) (after ToC)
- Nomenclature (after ToC)
- Acronyms if any (after ToC)
- The chapters (1, 2, … N, followed by the name of the chapter),
  - Sections within chapters (e.g. 1.1, 2.4, etc. + name)
    - Subsections within sections (e.g. 1.1.1 + name)
- Appendices (I, II, III, IV, .. etc. + name), if any
- References
- Publications if any

- Do not include the table of contents itself in the ToC.

- Use borderless table for ToC

3.6 List of Figures and Tables: Tables and figures should be numbered and captioned. Each table or figure should be numbered using a two-level scheme, (chapter no).(table no) or (chapter no).(figure no). This number (e.g. Table 4.8, or Fig. 3.7) should be used whenever the table/figure is referred in the text. Each table/ figure should have a title/caption. An identical entry should exist in List of Tables or List of Figures respectively. Title of a table is given at the top of the table preceded by its number. Caption of a figure is given at the bottom of the figure preceded by its number. Figures and tables should appear as close as possible to their first occurrence/mention in the running text of the chapter these belong to; these must appear after the first mention and not before. Photocopied tables should not be included. Photocopied figures should be avoided as far as possible and if included they should be large enough and clear. If taken from any reference, the reference should be cited within the text as well as at the caption of the figure or table.

3.7 Nomenclature: It is necessary whenever symbols are used. This is in order of English (i.e. Roman) letters (Uppercase followed by lowercase), Symbols in Greek letters (see Appendix for the alphabetical order of Greek letters), subscripts and superscripts used, Special Symbols, followed by acronyms (i.e., Abbreviations) if any; everything in alphabetical order. All entries in nomenclature should have appropriate units in SI system.

3.8 Numbering of Report: Every page of the report other than the title page should be numbered. Pages of Certificate, Acknowledgement, Table of Contents, Nomenclature, List of Tables and List of Figures should be numbered with lower case Roman numerals (i, ii, iii, iv, …etc.). From the first page of the first chapter onwards, all the pages should be numbered using Hindu-Arabic numerals (1, 2, 3, … etc.). The page numbers should appear at the bottom center as it is appearing in this document.

4 The Chapters: The number of chapters you need and their contents strongly depend on the topic selected and the subject matter to be presented. In general the following chapters may be included; however, it is your own report and you have to structure it according to the flow of overall logic and organization.

4.1 General Guidelines:

- Each chapter, section, subsection, etc. should have a title. An identical entry should exist in the ToC. Each chapter is numbered using Hindu-Arabic numerals: 1, 2, 3, ..

- Title with interrogative sentence should be avoided.

- The chapters may be structured in to sections and subsections. Sections within a chapter are numbered using a two-level scheme, (chapter no).(section no); for example, sections in chapter 3 are numbered 3.1, 3.2, ... Subsections within a section are numbered using a three-level scheme, (chapter no).(section no).(subsection no); for example, subsections in chapter 3, section 2 are numbered 3.2.1, 3.2.2, ... The sections and sub-sections must carry titles. Use different fonts for section titles and sub-section titles as specified in section 7.3.2 on page no 7.

- Presentation of your contributions should include formulation, derivations,

description of experimental set-up, experimental data/measurements, design calculations etc. For an experimental investigation, raw data must be available (preferably in an appendix). For a project involving software development, user's manual, programmer's manual, source code diskette/listing must be available. User's and programmer's manuals are considered to be separate documents, distinct from your report. As mentioned previously, these could form appendices.

- The SI system of units should be used as far as possible.

- Results/ Discussion/ Comments: If there are too many aspects to be covered then

organize them in a logical manner.

4.2 Introduction: In this chapter give introductory information about your project/dissertation/seminar and formulate the problem that you want to address, the statement of a problem and its relevance, the initial goals you had, etc. without going into details. Here you also describe the structure of the rest of your report, indicating which chapter will address which issue.

4.3 Literature Survey: It should be as exhaustive as possible but related to your work. The discussion on the literature may be organized under a separate heading & titled suitably. Summarize the literature that you have read. Rather than literally copying the texts that you have read, you should present your own interpretation of the theory. This will help you in developing your own thinking discipline and technical language. The last part of this section must contain a brief mention of the gaps in the literature and a justification for undertaking your study/project. Do not be too general. Avoid writing essays on historical developments.

4.4 Theory-Oriented Chapters: The basic theory necessary to formulate the subject matter may be presented under this chapter & titled suitably.

4.5 Practice-Oriented Chapters: Depending on the work that you have done, it might be important to write about the system specifications/design, practical details, system behavior and characteristics and cross links of the selected topic etc.(May be one or two chapters) eg Hardware Design, Software Development, Results and Discussion etc.

4.6 Conclusions: This is one of the most important chapters and should be carefully written. It should be broadly divided as objective or introduction, conclusions and future scope. Here you evaluate your study, state which of the initial goals was reached and which not, mention the strong and weak points of your work, etc. You may point out the issues recommended for future research. State these clearly, in point-wise form if necessary, with respect to the original objective. Do not disguise "descriptions" of specific aspects, covered in the work as conclusions.

4.7 Equations: Each equation should be numbered using a two-level scheme, (chapter no).(eq no). While typing, the equations should be centrally placed while equation numbers should be flush right. (LaTeX does this by default.) This number (e.g. 2.4, with 2 as chapter number and 4 as equation number) should be used (as Eqn. 2.4) whenever the equation is referred in the text. The equations should be clearly written. Symbols used in the equations should be explained immediately after the equation when they are referred first as well as in the nomenclature. SI units must be used throughout the report. Present equations in dimensionless form, wherever possible and appropriate.

4.8 Acronyms: Avoid acronyms (short forms) in the report except the following standard ones. Equation(s): Eq(s), Figure(s): Fig(s). The words 'Table' and 'Chapter' are not shortened. If any other acronyms have to be used, list them separately at the beginning (after nomenclature). Mention the acronym in the brackets following its full form, whenever it occurs first. The first word in a sentence shall never be a short form.

5.0 The Appendices: Appendices are useful for those things that you consider important, but that do not fit in the main presentation of your work and breaks the regular flow. There could be several reasons for using appendices: the material is too long and has too many details (e.g. the specifications of instruments or equipment), you have formulated a theorem, the proof of which is too long for the main text, you want to include a user manual for the software that you have come across (strongly recommended!), you want to present the schematics of a hardware design, experimental set-up, etc. Appendices tend to occupy many pages. Think carefully on what you want to include. For example, complete listings of the source code that you have written are seldom interesting. Instead, add a flow chart. Avoid describing the test set-up where a schematic can be easily used. Appendices are numbered as Appendix I, Appendix II, etc. or using capital English letters e.g. Appendix A, Appendix B, etc. If you have just one appendix, then it is not numbered. Alphabetical order of Greek letters: Alpha, beta, gamma, delta, epsilon, zeta, eta, theta, iota, kappa, lambda, mu, nu, xi, omicron, pi, rho, sigma, tau, upsilon, phi, chi, psi, omega. Since reference can be drawn to published/unpublished literature in the appendices these should precede the reference (or Literature Cited) section.

6.0 References: This should follow appendices, if any, otherwise the conclusion chapter. This chapter is also referred as "Literature Cited". Each entry in the reference has a label. All references cited in the text-body should be there in the Reference list and vice versa. Established acronyms may be used. e.g. AC, DC, ASME, ASTM, IIT, Jnl, etc., provided there is no likelihood of any confusion.

- **Labeling:** One of the following systems can be used for labeling the cited entries.

System 1: A numeric label arranged in an order of citation in the main text. This label is used in square brackets or as superscript at the point of citation, e.g. [34]. The references should be arranged together in the order of this numeric label.

System 2: A label derived from the authors name and the year of publication. For entries with 2 authors, include the surnames of both the authors followed by the year of publication. For entries with multiple authors, include the surnames of the first author followed by 'et al.' and the year of publication. This label is used in round brackets at the point of citation, e.g. (Taylor, 1982) or (Taylor et al., 1982) or (Taylor and Morgan, 1982).

- The references should be arranged together in the alphabetical order of the author surname (1st priority) and the year of publication (2nd priority).

- The reference list thus compiled together should be included after Appendices. In the reference list, you should provide the details of each entry in the following manner. These details differ depending on the type of bibliographic entry.

- For a book: name of the authors, title, publisher, city of publication and year of publication. (Taylor J. R., An Introduction to Error Analysis, Oxford University Press, Mill Valley, CA,USA, 1982)

- For an article in a journal: name of the authors, title, name of the journal, volume (issue number), range of pages, and year. (Bandyopadhyay S., Bera N.C. and Bhattacharyya S., 'Thermoeconomic Optimization of Combined Cycle Power Plants', Energy Conver. Mgmt., 42(3), 359-371, 2001.)

- For an article in conference proceedings: name of the authors, title, name of conference, editors (if present), range of pages and year. (Kedare S.B. 'Optics, Design, Performance and Economics of the Dynamic Fresnel Paraboloid Reflector Concentrator Dish with Point Focus for High Temperature Solar Thermal Applications', Proceedings of National Renewable Energy Convention '99, Sawhney R.L. (Ed.), 9-15, 1999.)

- **A chapter in a book:** authors of the chapter, title of the chapter, editors of the book, title of the book, publisher, city of publication, range of pages, and year of publication.(Bilgen E., Industrial Solar Power Stations, Veziroglu T.N. (Ed.), Solar Energy and Conservation: Technology, Commercialization, Utilization, Volume2, Pergamon Press, NY, USA, 665- 673,1978)

- **A report:** authors, title, university/company, report number, year. (Ahmed K., Renewable Energy Technologies, World Bank Technical Paper Number 240, 1994)

- **A Ph.D. or Masters Thesis:** author, title, department, university, year. (Kedare S.B., 'Investigations on a Reciprocating Wind Machine', Ph.D. Thesis, Dept. of Mechanical Engineering, IIT, Mumbai, 1991)

- **A manual / handbook / standards :** company name (if there are no authors), title, reference number, year. (British Standards Institution, Specification for Steel girder bridges, BS153 : Parts 3B & 4 : 1972, 1972)

- **A web-site :** Author or Organization, name of the site, complete address of the site, date visited (Danish Wind Industry Association, Aerodynamics of Wind Turbines: Lift, http://www.windpower.org /tour/wtrb/lift.htm, Aug 16, 2002)

- **Bibliography:** In a few exceptional cases, it is useful to suggest a list of publications for background reading. These are not cited anywhere in the text. This list can be included as 'Bibliography'. It should follow 'References' on a fresh page.

7.0 Additional Guidelines For Seminar/ Project Reports: Following are the additional important guidelines which shall be followed by all students.

7.1 Interaction With Guide: It is recommended that you meet your guide regularly during the course of the seminar/project, though ultimately the form of this interaction depends on both of you. You should maintain a record notebook/file where you can include a record of your discussions with your guide, literature survey details, derivations etc. Such a system will allow easy and quick access to the details and chronology of your work. The final responsibility for producing an error-free report lies with you, and not your guide.

7.2 Submission: Students shall follow the following guidelines for final submission.

- First, get draft copy of your report approved and certified by your guide and HoD.
- Submit only one copy per group of above report in spiral binding form to the Principal through HoD of your department on or before due date.
- Once the report is approved by the Principal then submits appropriate number of copies of final report in hard bound form.
- Number of copies to be submitted is no. of student + guide + library +department + no of examiners. The bound copies of your report should be submitted within the given deadline. Late submission may not be acceptable. Make sure that the certificate in your report is signed by concerned authorities before you make the final submission of the report.

7.2.1 Binding: The report shall be hard cover bound in leather or rexin (Black colour for B.E., Maroon for M.E.). The front cover shall be same as top cover page and all lettering shall be embossed in gold. In addition, emboss the title of project/dissertation/seminar, name of programme and month & year of submission on side strip of the report. At the time of final submission, if examination number is not allotted by NMU, Jalgaon; then don't emboss that line on top cover page.

7.3 Format:

7.3.1 Paper : It is mandatory to use plain A4 sized (height 297 mm, width 210 mm) good photocopying paper sheets, 70 to 90 gsm (16 to 20 pounds), whiteness 95% or above, smooth finish.

7.3.2 Typesetting, Text Processing and Printing:

- All material should be typed in 1.5 line spacing using times new roman and the vertical space between paragraphs shall be 2.5 line spacing. The first line of each paragraph should normally be indented by six characters.

- The recommended margins are 25 mm (1 inch) for top, bottom, right and left with an extra 13 mm (0.5 inch) for binding on the left. Other than page numbers, no material should intrude into these margins.

- Each chapter should commence with a chapter number (12 TNR Bold title case) and title (14TNR Capital Bold). The text should begin on the same page with 2 blank lines of 1.0 line spacing between the last line of the chapter title and the first line of your text material. Keep 1 blank line of 1.0 line spacing between the chapter number and the title of the chapter. Adjust the chapter number and the title to fall in the center of the page.

- Use Capital Bold, TNR 12 font for all two level subtitles in the chapter.

- Use Title Case (Each word capital) Bold, TNR 12 font for all three level subtitles in the chapter.

- Use Sentence Case (First word capital) Bold, TNR 12 font for all four level subtitles in the chapter.

- Use Title Case (Each word capital), TNR 12 font for all titles/captions of tables/figures.

- Use TNR 12 font for writing the text.

- All pages, including figures and tables, should be numbered. Figures and tables should be complete in all respects (legends, number, caption/title, reference (if any), coordinate labels with units). Experimental data should typically be represented by centered symbols, while theoretical data by continuous curves in figures. Photographs should be treated as being equivalent to figures, with the caption being placed at the bottom of the photograph.

- When displaying computer code listings (usually in an appendix) please ensure that these contain appropriate comment statements so that the code can be understood easily. It is always desirable to have a high degree of similarity between the variables names / symbols that you have used in the report and those which appear in the code (e.g. *D* and RHO etc.)

7.3.3 Page Limits: Avoid writing a report which is artificially fattened. Do not waste pages. Use space optimally.

7.4 Publications by the candidate: Papers, articles, technical notes etc. on the topic of the project/dissertation published by the candidate may be separately listed after the references. This may also be included in the contents. The candidate may also include reprints/zerox copy of proceeding of his/her publication after the references.

7.5 General Guidelines

- Please maintain consistent tense in your report.

- Do not keep flipping between past and present tense.

- It has been the norm to use the passive voice ("was done") in technical writing.

- A paragraph should normally comprise of more than one line.

- Only one line of any paragraph should not be left at the top or bottom of the page.

- Pay attention to detail and accuracy.

- Be clear, but concise.
- **Please make a sincere effort to weed out typographical errors. Remember, these mistakes will cost your marks and may even result in a re-submission.**
- If you have become tired of reading your report over and over again and suspect that this fatigue will cause you to overlook typos and grammatical mistakes get a friend to help you out (perhaps you can also provide similar help in reciprocation).
- Write introduction and conclusion after writing the main body of the report.
- Write the numbers 0 to 9 in words and the numbers > 9 in figure.
- Repetitions in the titles of figures and tables be strictly avoided.
- **All tables and figures included in the report shall be referred in the text.**
- If the candidate so desire he/she may dedicate the thesis/report to someone. The dedication statement shall be presented on separate page which shall follow the title page and it is neither numbered nor included in ToC.

7.5 Expectations From Work

- Literature survey of related work with a clear identification of gaps in the literature and the justification and desirability of undertaking the study.
- Theory / model equations including method of solution. This section may also contain a detailed rebuttal of some previous study.
- Experiment / design of experiments, description of equipment and materials, methods of analysis. This section may include a critique of some previous experimental work
- Salient observations on the results you have obtained such as the relationships between different variables and parameters, unusual trends, interpretations of the observed trends, comparison between theory and experiment, comparison with previous literature, limitations, justification of prior assumptions made, and inconsistencies.
- Summary of salient observations and trends, how the study filled some gaps in the literature, scope and desirability of further work on the problem, applications, potential areas

Guide lines for ICA:

Internal continuous assessment should support for regular performance and its regular assessment. In addition; it shall be based on knowledge/skill acquired and record (log book) submitted by student based on performance. The performance shall be assessed presentation or demonstration wise using internal continuous assessment format.

Guide Lines for ESE:

The End Semester Exam for this course shall be based on oral examination which covers content of Project, to judge the skills acquired by student.

ME 459 INDUSTRIAL VISITS / TRAINING

Evaluation scheme: ICA 50 Marks **Credits:** 01

Total Marks: 50

---

1. Industrial visits to minimum two industries shall be carried out by each student preferably or college shall arrange the industrial visit during the vacation period otherwise during the regular VII semester.
2. The student should obtain appropriate certificates of visit from the concerned organizations just after the visits.
3. Every Student should submit Industrial Visit report individually at the end of the Semester-VII (First Term of Final Year).
4. The report (Thermal Bound) should contain information about the following points:
    a. The organization – activities of organization and administrative setup technical personnel and their main duties.
    b. The project / industry brief description with sketches and salient technical information.
    c. The work / processes observed with specification of materials, products, equipments etc. and role of engineers in that organization.
    d. Suggestions (if any) for improvement in the working of those organizations.
5. The evaluation of the report of technical visits will be made by panel of three teachers appointed by Head of the department based on following points:

Guide lines for ICA:

ICA shall be based on knowledge gain by student and Industrial Visit Report submitted by the student in the form of Thermal bound. Assessment of the Industrial Visit for award of ICA marks shall be done jointly by industrial visit coordinators departmental committee based on viva –voce as per the guidelines given in **Table- C.**

Table- C:-

Class:- **Semester :-** **A- Year :-**

Name of Industry visited / training taken: - **Duration:-**

Sr. No.:	Name of student	Name of Industry	Report Writing	Depth of Understanding and presentation	Total
			25	25	50
1.					

ME 460 INDUSTRIAL LECTURES

Teaching Scheme: 01L, **Total:** 01
Total Marks: 50 ICA **Credits:** 01

1. There is a need to create avenues for a close academia and industry interaction through all the phases of technology development, starting from conceptualization down to commercialization.
2. List of renowned persons from industry shall be prepared by the committee appointed by Head of the department. After approval from the Principal, Minimum five Industrial lectures in alternate week shall be arranged, which shall be delivered by the experts/Officials from Industries/Govt. organizations/ Private Sectors/Public Sectors / R&D Labs covering the various aspects.
3. Topics of Industrial Lectures shall be Technical in nature and should not be the specific contents from the curriculum.
4. Students shall submit the report based on minimum five lectures giving summary of the lecture delivered.
5. The summary should contain brief resume of the expert, brief information of his organization and brief summary of the lecture in bullet point form.

Guide lines for ICA:

Assessment of the Industrial Lecture for award of ICA mark shall be done jointly by departmental committee as per attendance in industrial lecture, report submitted by student and overall performance in semester as per the guidelines given in Table- D

Table D:-
Expert lecture on topic :-
Name. of Expert and designation :-
Class:- **Semester :-** **A- Year :-**

Sr. No	Name Of Student	Attendance (05 Marks Per Lecture)	Dept Of Understanding (03 Marks Per Lecture)	Report Writing	Total
		25	**15**	**10**	**50**
1.					
2.					

Remarks (if any):-

_____
_____
_____

ME 461 SELF STUDY - IV

Teaching Scheme: 00**, Total:** 00 **Credit:** 02
Evaluation Scheme: 50 **Total Marks:** 50

Content and Guide line:-

The 20% syllabus for self - study shall be declared by subject teacher of FOUR subjects at the beginning of semester and he/she shall conduct the test examination for that course, assess answer papers of test examination and submit the marks to course coordinator.

Marks and hence grade of course Self Study I shall be based on one test each conducted on 20% syllabus of five subjects ME451, ME452, ME453 and ME454. One faculty member should be appointed as course coordinator for the course ‘self study’ to compile the marks of all tests and enter into the MIS.