GOVERNMENT COLLEGE OF ENGINEERING, AURANGABAD

(An Autonomous Institute of Government of Maharashtra)

Department of Mechanical Engineering

Teaching and Evaluation Scheme

SE (Full-Time) in Mechanical Engineering

SEMESTER-III

S. No.	Course Code	Subject	Scheme of Teaching (Hrs/Week)			Total Credits	Scheme of Evaluation (Marks)					
			L	T	P		Theory			Term Work	Practical/ Viva-voce	Total
							Test	TA	ESE			
THEORY COURSES												
1	GE241	Engg. Mathematics-III	3	1	-	4	20	20	60	-	-	100
2	GE242	Environmental Studies	3	-	-	3	20	20	60	-	-	100
3	ME243	Engg. Thermodynamics	3	1	-	4	20	20	60	-	-	100
4	ME244	Machine Drawing	4	-	-	4	20	20	60	-	-	100
5	ME245	Manufacturing Process	3	-	-	3	20	20	60	-	-	100
LABORATORY COURSES												
1	ME246	Lab-Engg. Thermodynamics	-	-	2	1	-	-	-	25	25	50
2	ME247	Lab-Machine Drawing	-	-	4	2	-	-	-	50	50	100
3	ME248	Lab CAME-1	-	-	2	1	-	-	-	25	25	50
4	ME249	Workshop Practice-III	-	-	4	2	-	-	-	50	50	100
			16	2	12	24	100	100	300	150	150	800

SEMESTER-IV

S. No.	Course Code	Subject	Scheme of Teaching (Hrs/Week)			Total Credits	Scheme of Evaluation (Marks)					
			L	T	P		Theory			Term Work	Practical/ Viva-voce	Total
							Test	TA	ESE			
THEORY COURSES												
1	ME261	Open Elective	3	-	-	3	20	20	60	-	-	100
2	ME251	Electrical Machines	2	-	-	2	10	10	30	-	-	50
3	ME252	Mechanisms of Machines	3	1	-	4	20	20	60	-	-	100
4	ME253	Applied Thermodynamics	3	-	-	3	20	20	60	-	-	100
5	ME254	Strength of Material	3	1	-	4	20	20	60	-	-	100
6	ME255	Machine Tools	3	-	-	3	20	20	60	-	-	100
LABORATORY COURSES												
1	ME256	Lab Electrical Machines	-	-	2	1	-	-	-	50	-	50
2	ME257	Lab Mechanisms of Machines	-	-	2	1	-	-	-	25	25	50
3	ME258	Lab App Thermodynamics	-	-	2	1	-	-	-	25	25	50
4	ME259	Lab. Strength of Material	-	-	2	1	-	-	-	25	25	50
5	ME260	Workshop Practice -IV	-	-	2	1	-	-	-	25	25	50
			17	2	10	24	110	110	330	150	100	800

L-Lectures, T-Tutorials, P-Practicals, TA-Teacher Assessment, ESE-End-Semester Examination

Open Elective

ME 261 – Total Quality Management

GOVERNMENT COLLEGE OF ENGINEERING, AURANGABAD

(An Autonomous Institute of Government of Maharashtra)

Department of Mechanical Engineering

Teaching and Evaluation Scheme

SE (Part-Time) in Mechanical Engineering

SEMESTER-I

S. No.	Course Code	Subject	Scheme of Teaching (Hrs/Week)			Total Credits	Scheme of Evaluation (Marks)					
			L	T	P		Theory			Term Work	Practical/ Viva-voce	Total
							Test	TA	ESE			
THEORY COURSES												
1	GE242	Environmental Studies	3	-	-	3	20	20	60	-	-	100
2	ME243	Engg. Thermodynamics	3	1	-	4	20	20	60	-	-	100
3	ME244	Machine Drawing	4	-	-	4	20	20	60	-	-	100
LABORATORY COURSES												
1	ME246	Lab-Engg. Thermodynamics	-	-	2	1	-	-	-	25	25	50
2	ME247	Lab-Machine Drawing	-	-	4	2	-	-	-	50	50	100
3	ME249	Workshop Practice-III	-	-	4	2	-	-	-	50	50	100
			10	1	10	16	60	60	180	125	125	550

SEMESTER-II

			L	T	P		Theory			Term Work	Practical/ Viva-voce	Total
							Test	TA	ESE			
THEORY COURSES												
1	GE241	Engg. Mathematics-III	3	1	-	4	20	20	60	-	-	100
2	ME245	Manufacturing Process	3	-	-	3	20	20	60	-	-	100
3	ME261	Open Elective	3	-	-	3	20	20	60	-	-	100
4	ME252	Mechanisms of Machines	3	1	-	4	20	20	60	-	-	100
LABORATORY COURSES												
1	ME248	Lab CAME-1	-	-	2	1	-	-	-	25	25	50
2	ME257	Lab Mechanisms of Machines	-	-	2	1	-	-	-	25	25	50
			12	2	4	16	80	80	240	50	50	500

SEMESTER-III

			L	T	P		Theory			Term Work	Practical/ Viva-voce	Total
							Test	TA	ESE			
THEORY COURSES												
1	ME251	Electrical Machines	2	-	-	2	10	10	30	-	-	50
2	ME253	Applied Thermodynamics	3	-	-	3	20	20	60	-	-	100
3	ME254	Strength of Material	3	1	-	4	20	20	60	-	-	100
4	ME255	Machine Tools	3	-	-	3	20	20	60	-	-	100
LABORATORY COURSES												
1	ME256	Lab Electrical Machines	-	-	2	1	-	-	-	50	-	50
2	ME258	Lab App Thermodynamics	-	-	2	1	-	-	-	25	25	50
3	ME259	Lab. Strength of Material	-	-	2	1	-	-	-	25	25	50
4	ME260	Workshop Practice -IV	-	-	2	1	-	-	-	25	25	50
			11	1	8	16	70	70	210	125	75	550

L-Lectures, T-Tutorials, P-Practicals, TA-Teacher Assessment, ESE-End-Semester Examination

Open Elective ME 251 – Total Quality Management

Dr. R.K. Shrivastva
BOS, Chairman-Mech.-Engg
Govt. College, Aurangabad

GE 241: Engineering Mathematics-III (For All Branches)

Teaching Scheme
Lectures: 3hrs / week
Tutorial: 1 hr/week

Examination Scheme
Class Test: 20 marks
Teacher's Assessment: 20 marks
End Sem Exam: 60 marks

Course Objectives: To equip students with

1. adequate knowledge of mathematics that will enable them in formulating problems and solving problems analytically
2. solve related problems which will enable them to understand the subject and their Engineering Applications

Unit 1: nth order Linear differential equations (6L+2T)

Methods of finding general solution of homogeneous and non- homogeneous linear differential equation with constant coefficients: General method, shortcut method, method of variation of Parameter; General solution of homogeneous and non-homogeneous linear differential equations with variable coefficients; Simultaneous Linear differential equations.

Unit 2: Partial Differential equations (6L+2T)

Introduction of partial differential equations, Formation of partial differential equations, solution of First-order Linear and non Linear partial differential equations by char pit's method/Adomian method. Method of separation of variables. Boundary value problems.

Unit 3: Applications of differential equations (6L+2T)

(a)Applications of ordinary differential equations: Mechanical oscillations: Free oscillations, Damped free Oscillations, Forced oscillations, Electrical circuits, Applications in civil Engineering: Deflection of beams.

(b)Applications of partial differential equations One dimensional heat flow equation, two dimensional heat flow equation under steady state condition.

Unit 4: Laplace transform and its applications (6L+2T)

Definition, Laplace transform of some basic functions, Properties of Laplace transform ,Laplace transform of Unit step function, Unit impulse function, error function, and periodic function, Use of Laplace transform to solve Linear differential equations and simultaneous linear differential equations.

Unit 5: Vector calculus (6L+2T)

Vector differentiation, Tangential and normal components of velocity and acceleration, Gradient of scalar point function, Divergence and Curl of vector point function and their applications. Line, surface and volume integrals, Stoke's theorem and Gauss-Divergence theorem.

Text Books : -

1. A Text Book of engineering Mathematics (Vol.1 &2) by P.N.Wartikar & J.N.Wartikar, Pune Vidhyarthi Griha Prakashan, Pune.
2. Advanced Engineering Mathematics by Erwin Kreyszig, Willey Eastern Ltd. Mumbai.
3. Engineering Mathematics-A Tutorial Approach by Ravish R Singh, Mukul Bhatt.

Reference Books: -

1. Higher Engineering Mathematics by B. S. Grewal, Khanna publication, New Delhi.
2. Advanced Engineering Mathematics by H. K. Dass, S. Chand and Sons.
3. Advanced Engineering Mathematics by Michael Greenberg,2/e, Pearson
4. Calculus by G. B. Thomas and R. L. Finney, Addison- Wesley, 1996
5. Elements of Partial Differential Equations by I.N.Sneddon

ME243: ENGINEERING THERMODYNAMICS

Teaching Scheme
Lectures: 3 hrs/week
Tutorial: 1 Hr/Week

Examination Scheme
Class Test – 20 marks
Teacher's Assessment – 20 marks
End Sem Exam – 60 marks

Objectives: To familiarize with

1. Understand various types of energies and its applications in thermodynamic systems
2. Applying thermodynamic concepts to thermodynamic systems
3. Know various laws of thermodynamics and applications to thermodynamic system
4. Application of ideal gas processes to thermodynamic systems
5. Study steam properties, Interpret steam tables and Mollier charts with numerical applications
6. Understand and analyze (numerical analysis) various types of air standard cycles
7. To know various types of fuels their properties and applications
8. To know the chemical analysis (Numerical treatment) of fuels and exhaust gases

Outcomes: Able to

1. Accustom with type of energy and thermodynamic systems
2. Apply First law of thermodynamics
3. Analyze thermodynamic systems
4. Define state of steam
5. Analyze thermodynamic cycle performance
6. Do chemical analysis of fuel

Unit-1: First Law applied to Steady Flow Processes **5 Hours**

Conservation of energy, steady flow processes, SFEE, modification of SFEE for different engineering devices such as nozzles, blowers, I.C. Engines, Compressors, Pumps, Turbines, throttling devices, etc. (Numerical Treatment)

Unit-2: Second Law of Thermodynamics **5 Hours**

Limitations of first law of thermodynamics, various statements of second law of thermodynamics, thermodynamic temperature scale, Entropy, entropy as a property, available and unavailable energy, availability, Quality of energy, reversible process and irreversible process, Carnot Theorem, Carnot cycle (Descriptive Treatment)

Unit-3: Properties of steam and pure substances **7 Hours**

Pure substance, phase, phase transformation of water at constant pressure, p-v phase diagram, critical point, Triple point, Different stages, Entropy of steam, steam tables, processes of steam, Enthalpy-Entropy diagram, steady flow process and determination of dryness fraction of steam (Numerical Treatment)

Unit-4: Power cycles **6 Hours**

Definition of cycles, power producing cycles and power consuming cycles, Air standard cycles, air standard efficiency, Carnot cycle, Otto cycles, Diesel cycles, Dual combustion cycles, Comparison of Otto, Diesel and dual combustion cycles, Efficiency versus compression ratio for the same heat input, for constant maximum pressure and heat supplied. Fuel air cycle, Brayton cycles, Atkinson cycle, Ericsson cycle (Numerical Treatment)

Unit-5: Fuels and Combustion **7 Hours**

Introduction, classification of fuels, calorific heating value of fuels, Determination of C.V. of fuels, Solid fuels, liquid fuels, gaseous fuels, Orsat apparatus, determination of minimum air required for combustion. Conversion of volumetric analysis to mass analysis, Combustion of gaseous fuels, conversion of volumetric analysis of gas into mass analysis (Numerical Treatment)

Reference Books

1. Nag P.K., "Engineering Thermodynamics", TMH Publishing Co. New Delhi
2. Rajput R.K., "A Text Book of Engineering Thermodynamics", Laxmi Publication, New Delhi
3. Ballaney P.L., "Thermal Engineering", Khanna Publications, New Delhi
4. S. Domkundwar, Dr. C. P. Kothandaraman & A. Domkundwar, "A Course in Thermal Engineering", Dhanpat Rai and Co., New Delhi
5. Y. V. C. Rao, "Engineering Thermodynamics", Universities Press, Hyderabad

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ME244: MACHINE DRAWING

Teaching Scheme
Lectures: 4 hrs/week

Examination Scheme
Class Test – 20 marks
Teacher's Assessment – 20 marks
End Sem Exam – 60 marks
(Duration: 4 Hours)

Objectives: Familiarize with

1. To understand the intersection curves for joining the surfaces
2. To apply fundamental concepts of various curves and its use in manufacturing
3. To understand various developed surfaces in sheet metal product manufacturing
4. To know various types of fasteners, joints and their practical application

Outcomes: Able to

1. Define the intersection curves in sheet metal work
2. Apply concept of curves in manufacturing
3. Apply the knowledge of developed surfaces in sheet metal product manufacturing
4. Decide and apply fasteners joints in practice

Unit 1: Intersection of Surfaces **11 Hours**

Line or Curve of intersection of two solids, Methods: Line method, Cutting-plane method. Intersection of vertical prism with prism, cylinder, cone (Horizontal or Inclined), Intersection of vertical Cylinder with cylinder, cone, prism (Horizontal or Inclined), Intersection of vertical cone with cone, prism, cylinder (Horizontal or Inclined), Intersection of Sphere with cylinder, prism (Horizontal or Inclined).

Unit 2: Engineering Curves & Gearing **9 Hours**

Introduction: Conics section, Cycloidal curves, Involute curves, and spirals

Directrix, focus, eccentricity, Normal & Tangents, Construction of ellipse by directrix focus method, concentric circle method, arcs of circle method, oblong method, Construction of Parabola / hyperbola by directrix focus method, Rectangle method, Tangent method, Cycloid- Epicycloid & hypocycloid, Trochoid- Epitrochoid & Hypotrochoid (Theoretical treatment only)

Gears: construction of spur gear tooth profile by accurate / approximate method

Unit 3: Development of Surfaces **8 Hours**

Introduction: Methods of Development, Development of lateral surfaces of right solids- Cube, Prism, Cylinders, Pyramids, Cone, Development of Transition Pieces, Spheres

Unit 4: Machine Elements **12 Hours**

Screwed Fastenings- Introduction, Screw Thread Nomenclature, Form of the Screw Threads, Thread Series, Designation, Thread Profiles, Multistart Threads, Right Hand and Left Hand Threads, Representation of Threads, Bolted Joints, Studded Joint, Eye Bolt, Machine Screws and Cap Screws, Set Screws, Locking Devices for Nuts.

Riveted Joints-Introduction, Classification of Riveted Joints, Terminology of Riveted Joints, Processes for Producing Airtight Joints, Rivet Heads.

Welded Joints-Introduction, Welding Methods, Types of Welded Joints, Representation of Welds on Drawing as per IS standard

Reference Books

1. Bhatt N. D., Panchal V. M., "Engineering Drawing", Charotar Publishing House
2. Dhabhade M. L., "Engineering Graphics", Vol.- I and Vol.-II, Vision Publications, Pune
3. Gill P. S., "Engineering Drawing", S. K. Katariya & Sons, Delhi
4. Bhatt N. D., Panchal V. M., "Machine Drawing", Charotar Publishing House
5. Mali / Chaudhari, "Machine Drawing", Vrinda Publication, Jalgaon

ME245: MANUFACTURING PROCESSES

Teaching Scheme
Lectures: 3 hrs/week

Examination Scheme
Class Test – 20 marks
Teacher's Assessment – 20 marks
End Sem Exam – 60 marks

Objectives:

1. To know various moulding processes and tool
2. Understand various pattern making tools and processes
3. Understand fundamental concept of plastic manufacturing processes
4. Understand various forging processes and its tools and heat treatment

Outcomes:

1. To apply fundamental concept of moulding in practice
2. To develop the knowledge of pattern making and related concepts
3. Application of concept of plastic processing
4. Enhance the knowledge of forging operation

Unit – 1: Moulding **6 Hours**

Moulding tools and equipments, moulding sands, types of moulding sand, grain shape and size of sand, sand additives, properties of moulding sand preparatory, sand testing, moulding processes, moulding processes based on sand used, making a green sand mould, typical moulding problems, machine moulding, core and core making, cleaning of casting

Unit – 2: Pattern Making **6 Hours**

Introduction, pattern making tools, sawing tools, making and layout tools, pattern materials, factors affecting selection of pattern materials, master patterns, pattern allowance, types of pattern, core print, core boxes, wood working machines, types of wood working machines

Unit – 3: Plastics and Their Processing **6 Hours**

Introduction, polymers, classification, polymer additives, cellulose derivatives, synthetic resins, elastomer, plastic processing methods, forming methods, lamination of plastics, joining of plastics

Unit – 4: Forging **6 Hours**

Introduction, forging materials, heating devices, forging temperatures, hand tools and appliances smith forging operations, forging processes, hand forging, power forging, impression die forging, drop hammers, press forging, roll die forging press verses hammer forging, machine or upset forging, high energy rate forging, effects of forging, defects in forging, heat treatment of forging, advantages and disadvantages

Unit – 5: Mechanical Working of Metals and Joining Processes **6 Hours**

Introduction, hot working, hot rolling, piercing of seamless tubing, drawing, deep drawing, hot spinning, cold working, cold rolling, cold drawing, cold bending, cold spinning
Welding processes- Introduction, weldability, types of welding, newer welding methods

Reference Books

1. DeGarmo, Black Konser, "Materials and Processes in Manufacturing", PHI, New Delhi
2. Schey J. A., "Introduction to Manufacturing processes", Mc Graw Hill, New Delhi
3. Lindberg A., "Processes and Materials of Manufacturing", Lindberg
4. Raghuvanshi B.S., "Workshop Technology", Vol I, Asia Publishing House
5. Hazra Choudhary, "Elements of Workshop Technology", Vol I, Khanna Publishers
6. Jain R.K., "Production Technology"Khanna Publisher, New Delhi
7. Bawa H.S., "Workshop Technology", Vol I Mc Graw Hill, New Delhi

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ME246: LAB – ENGINEERING THERMODYNAMICS

Teaching Scheme
Practical: 2-hrs/week

Examination Scheme
Term work: 25 marks
Practical: 25 marks

Objective: Acquiring practical knowledge of thermodynamic systems
Outcome: Hands on experience of various thermodynamic systems

All the experiments from the following list should be conducted during the course and record for the same should be submitted:

1. Study of any two boilers:
   a) Babcock and Wilcox boiler and
   b) Any high-pressure boiler
2. Mountings and Accessories of boilers
3. Study and determination of C.V. of solid / liquid fuel using Bomb Calorimeter.
4. Study and determination of C.V. of gaseous fuels using Boy's Gas calorimeter.
5. Analysis of exhaust gases using Orsat apparatus.
6. Determination of dryness fraction of steam using tank calorimeter.
7. Determination of dryness fraction of steam using separating and throttling calorimeter.
8. Visit to industry related to thermodynamics.

Term work

The term work will consist of submitting a file for all the experiments with neatly written records of the study and diagrams.
The term work will be assessed by the course coordinator

Practical Examination

The Practical Examination will comprise of performing the experiment and viva voce on the syllabus
The practical will be assessed by two examiners, one will be the course coordinator and other will be examiner appointed by DSB

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ME247: LAB - MACHINE DRAWING

Teaching Scheme
Practical: 4 hrs/week

Examination Scheme
Term Work – 50 Marks
Practical / Oral – 50 Marks

Objectives: Acquiring knowledge of understanding and drawing machine component
Outcomes: Enhance the knowledge of drawing machine components

Term Work

Laboratory work shall consist of drawing problems (3 to 4) on half imperial drawing sheet containing problems on Unit – 1 to Unit – 4 of Machine Drawing theory syllabus. Draw one Assembly and one detailed drawing based on any one machine component. At least one sheet has to be drawn using any suitable software package

Students have to submit all the drawing sheets duly checked by the course coordinator and bound in the folder. The course coordinator will assess the term work.

Practical / Oral Examinations

Viva – voce based on the drawing sheets submitted as Term work, syllabus, and Assignment submitted.

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ME248: LAB- COMPUTER APPLICATIONS IN MECHANICAL ENGINEERING- I

Teaching Scheme
Practical: 2 hrs/week

Examination Scheme
Term work: 25 marks
Practical: 25 Marks

Objective: Acquiring practical knowledge of 3D CAD packages
Outcome: Enhancing practical knowledge about 3D CAD packages

Term work

At least two problems on 3D drafting of mechanical components on any of the available 3D CAD packages in the laboratory. The problems should be done individually by the students.

- The term work will consist of submitting a file for all the problems with neatly written records and printouts of the models.
- The term work will be assessed by the course coordinator

Practical Examination

The Practical Examination will comprise of Viva-voce based on term work and on the syllabus
The practical will be assessed by two examiners, one will be the course coordinator and other will be examiner appointed by DSB

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ME249: WORKSHOP PRACTICE- III

Teaching Scheme
Practical 4- Hrs/Week

Examination Scheme
Term Work: 50 Marks
Practical: 50 Marks
(Duration: 6 Hours)

Objectives: To acquire the hands on experience and skills for various turning operations, milling operations, welding, forging and black smithy methods
Outcomes: Enhancing the skills in machining operations like turning, milling, welding and blacksmithy

1. Turning Shop: Study of different operations to be carried on the lathe machine, taper turning methods (calculations), single point cutting tool operations, external threading, facing, finishing cuts, internal threading, safety precautions etc.
Job: preparing a job on lathe machine performing the above operations

2. Machine shop: study of different operations to be carried on the milling machine, the use indexing, gear cutting, slot cutting, spline cutting, and safety precautions etc
Job: preparing at least one job involving indexing operations, spur gear cutting

3. Welding Shop: Different welding machines and equipments, types of welding and welded joints, used in fabrication, preparation for weld joints, joint finishing, different tools, types of electrodes, angle cutters, portable grinder, drills, safety precautions etc.
Job: Preparing a job individually or in a group of students of any useful item of daily use using various welding operations.

4. Forging and Black smithy shop: Study of different forging operations, hand forging, power forging, heating devices, forging temperatures, different forging tools, safety precautions etc.
Job: preparing a useful job involving upsetting, elongation, bending, tapering, and changing cross sections, job to be done by hand forging performing the above operations

Term Work

The term work will consist of submitting a file for all the shops with neatly written records of the study and diagrams. A workshop diary should be maintained by the students to record the progress of the jobs done.
The term work will be assessed by the course coordinator

Practical Examination

The Practical Examination will comprise of two jobs in any two shops. The jobs should involve all the operations studied during the semester. Duration will be three hours for each job. Question paper will be set for all four shops.
The jobs will be assessed by two examiners, one will be the course coordinator and other will be examiner appointed by DSB.

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ME 261: OPEN ELECTIVE: TOTAL QUALITY MANAGEMENT

Teaching Scheme
Lectures: 3 hrs/week

Examination Scheme
Class Test – 20 marks
Teacher's Assessment – 20 marks
End Sem Exam – 60 marks

Objectives:

1. To know the basics and philosophies of TQM
2. To illustrate the use of total quality control tools
3. To understand the concepts quality circles and kaizen
4. To understand the techniques of JIT
5. Concepts of re-engineering, BPR

Outcomes:

1. To enable students capacity to apply the TQM philosophies
2. To develop the skills of applying tools of total quality control
3. To build the knowledge of implementation of quality circle and Kaizen in organization
4. Able to implement the concepts of JIT
5. Enhance the knowledge of BPR processes

Unit 1: Introduction to TQM **6 Hours**

Customer orientation, continuous improvement, Quality, Productivity and flexibility, approaches and philosophies of TQM, Quality Awards, Strategic Quality Management, TQM and corporate culture

Unit 2: Total Quality Control **6 Hours**

Basic analytical tools-check sheets, Histograms, Pareto charts, Cause and Effect diagrams, flow charts, scatter diagrams, run charts, Cost of Quality; Quality cost measurement, Reliability and failure analysis

Unit 3: Quality Circles **6 Hours**

Introduction, implementation, formation, intangible impact of quality circle, inhibiting factors, Kaizen: Introduction, the Japanese style of management & Kaizen implementation, modeling kaizen process and benefits

Unit 4: Just in Time Manufacturing **6 Hours**

Introduction, advantages, approach to quality, importance of KANBAN in JIT, Introduction to ISO 9000 and 14000 series of Quality Standard, Certification Requirements, Evolving Standards

Unit 5: Business Process Re-engineering **6 Hours**

Re-Engineering, definition, strategic value added process, re-engineering trends, incremental improvement program, stages of re-engineering, preparation identification, vision, technical and social design, transformation, Differentiation of BPR

References Book

1. W. Edward Deming, 'Out of crisis', MIT publishing
2. Ishikawa & Lu, 'What is Total Quality Control? The Japanese way', Prentice Hall
3. D. J. Tally, 'Total Quality Management', ASQC Quality Press
A. V. Feigenbaum, 'Total Quality Control', McGraw Hill International Editions, USA
4. J. M. Juran, 'Quality Control Handbook', McGraw Hill Book Company, USA
5. Masaaki Imai, 'Kaizen: The key to Japan's Competitive Success', McGraw Hill International Editions, USA

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ME251: ELECTRICAL MACHINES

Teaching Scheme
Lectures: 2 hrs/week

Examination Scheme
Class Test – 10 marks
Teacher's Assessment – 10 marks
End Sem Exam – 30 marks

Objectives: To introduce fundamental concepts, principles of electrical machines. This course aims to provide basic knowledge and to develop practical skills to solve engineering problems of all machines
Outcomes: Student will be able to

1. Learn basic concepts of DC machines and AC machines
2. Develop practical skills through different test, applications of DC machines and AC machines

Unit – 1: DC Generator **3 Hours**
Constructional features, basic principle of working, EMF equation, type of DC generators, applications of different types of generators

Unit – 2: DC motor **3 Hours**
Principle, Significance of back EMF, torque & speed equation, separately & self excited motors, speed control, applications of motors

Unit –3: Induction Motor **7 Hours**
Construction of 3-phase squirrel cage and phase wound rotor, Operation, types, production of rotating magnetic fields, principle of operation, torque equation under starting & running condition, condition for maximum torque, torque – slip characteristics, applications of induction motor
Single Phase Induction Motors: principle of operation, construction, types and application, types of single phase induction motors

Unit – 4: Alternators and Synchronous Machines **4 Hours**
Alternators: Principle of operation, construction, types, EMF equation, applications of types of alternators, Synchronous machines – principle of operation, applications

Unit – 5: Special purpose motors **3 Hours**
Construction, basic principle of working, applications of servomotor, permanent magnet DC Motor Stepper motor

Reference Book

1. A. E. Fitzgerald & C. kingsley & S. D. Umans, "Electric Machinery", Tata McGraw Hill, New Delhi
2. A.E. Clayton & N. N. Nancock, "The performance & Design of DC Machines"' CBC Publications & Distributors, Delhi
3. Nagrath I. J., Kothari D. P. , 'Electric Machines', Tata McGraw-Hill, New Delhi
4. Ashfaq Husain, 'Electrical Machines', Dhanpat Rai & Co.

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ME252: MECHANISMS OF MACHINES

Teaching Scheme
Lectures: 3 hrs/week
Tutorial: 1 Hr/Week

Examination Scheme
Class Test – 20 marks
Teacher's Assessment – 20 marks
End Sem Exam – 60 marks
Duration: 4 Hours

Objectives:

1. Develop concepts of kinematic, kinematics links and its applications in various mechanisms use in practice and knowledge of different relative motions of machine components
2. Understand and develop concept of relative and instantaneous velocity, develop mathematical ability of solving practical problem with selecting appropriate method for analysis
3. Understand concept of radial and tangential acceleration and its analysis
4. Recognize the use of various cam mechanisms, motions and accelerations, identify, formulate and solve problems based on cam
5. Understand the terminology of gears and its concepts, identify, formulate and solve problems based for various parameters of gears

Outcomes:

1. Apply the fundamental concepts of kinematic, kinematics links and its applications in various mechanisms use in practice and able to decide feasibility of mechanism
2. Use and apply the knowledge of relative and instantaneous velocity, develop ability to formulate and solve problems based on above in practice and able to analyze designed mechanism
3. Apply knowledge of radial and tangential acceleration to solve the practical problems based on mechanisms and its analysis
4. Acquire knowledge of cam mechanisms, its motions and accelerations and develop analytical ability to solve practical problems
5. Apply knowledge of gears, gearing action in practice for developing the gear train or profile

Unit 1: Kinematics **6 Hours**

Science of Mechanics, Kinematic links, Kinematic pairs, classification of pairs, Kinematic chains, planar, spherical, and spatial mechanisms, mobility, kutzbach criteria, Grubler criteria, problems based on above criteria, classification of mechanism , straight line generators, coupler curves, inversion of basic kinematic chain, Grashof's law

Unit 2: Velocity Analysis **6 Hours**

Instantaneous centre method, properties of instantaneous centre, number of instantaneous centre, types, Aronhold Kennedy's theorem, method of locating instantaneous centers in a mechanism, method of determining linear velocity of a point on a link, angular velocity of a link: link to link method, line of centers method.
Linear and angular velocities using Relative velocity method, rubbing velocity at a pin joint

Unit 3: Acceleration Analysis **6 Hours**

Centripetal or radial acceleration, tangential acceleration, total acceleration of a point on link, method to obtain acceleration polygon for a mechanism, angular acceleration of link, acceleration of intermediate and offset points, slider crank mechanism, Coriolis acceleration component, crank and slotted lever mechanism
Short cut methods for kinematic analysis of mechanism: Klein's construction, Ritterhaus's construction, Bennett's construction modified Kleins construction for four bar mechanism

Unit 4: Cams **6 Hours**

Classification of cams and follower, terminology, Analysis of follower motion: constant/uniform velocity, SHM, constant/uniform acceleration & deceleration/retardation, cycloidal, polynomial

motion, & derivation, graphical synthesis of plate cams using knife edge, roller follower, radial / off-set follower, translating / oscillating motion of follower, determination of velocity & acceleration for these motion

Unit 5: Gears **6 Hours**

Gear terminology, types, field of application, Spur gear: condition for correct gearing, conjugate profiles, cycloidal, involute, interference and undercutting, methods of eliminating interference, determination of length of path of path of contact, length of path and arc of approach and recess

Spiral gear: spiral angles, normal pitch, and center-to-center distance, efficiency of power transmission, force analysis

Helical and Herringbone gears, their relative merits and demerits over spur gear

Reference Books

1. Shigley J. E. and Uicker J. J., "Theory of Machines and Mechanisms", 3rd Edition, McGraw Hill Intl.
2. Hartenberg and Denavit, "Kinematic Synthesis of Linkages", McGraw Hill International
3. Rao J. S. & Dukkipati R. V., "Mechanism and Machine Theory", 2nd Edition, New Age Intl. Publishers
4. Ratan S. S., "Theory of Machines", Tata McGraw Hill Publishing Company Ltd.
5. Sharma C. S. and P. Kamlesh, "Theory of Mechanisms and Machines", Printice Hall of India Pvt. Ltd.
6. K. J. Waldron, and G. L. Kinzel, "Kinematics, Dynamics, and Design of Machinery", John Wiley & Sons, Inc.
7. D. H. Myszka, "Machines & Mechanisms: Applied Kinematic Analysis", 2nd Edition, Pearson Education
8. Khurmi R. S. and Gupta J. K., "Theory of Machines", S. Chand Publication, New Delhi

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ME253: APPLIED THERMODYNAMICS

Teaching Scheme
Lectures: 3 hrs/week

Examination Scheme
Class Test – 20 marks
Teacher's Assessment – 20 marks
End Sem Exam – 60 marks

Objectives:

1. To understand and analyze performance of air compressor
2. Get familiar with the various systems of IC engines
3. To study the VCR and non conventional refrigeration systems
4. To understand and analyze vapour power cycles
5. To study various types and function of condensers and cooling towers

Outcomes: - Students will be able to

1. Select the type of compressor for the particular application
2. Differentiate among different internal combustion engine designs and give an engine design specification
3. Identify part and describe the functions of various parts of refrigeration systems
4. Analyse the performance of vapour power cycles
5. Select the type of condenser and cooling tower for particular application

Unit-1: Gas Compressors **8 Hours**

A) Classifications and working principles, Reciprocating compressors. Terminologies used, effect of clearance volume, actual indicated diagram, multistage compression, two stage compressors (Numerical problems on reciprocating compressors)

B) Rotary compressors, working principles, Roots blower, Vane type blower, Centrifugal compressor, axial flow compressor, Comparison between reciprocating and rotary compressors, Vacuum pumps, air motor (Descriptive treatment only)

Unit-2: I.C. Engines **6 Hours**

Classifications, components, working of 2-Stroke, 4-Stroke, Spark Ignition and Compression ignition engines, Valve timing diagrams, Carburetor, different circuits of carburetors such as idling, throttling, compensating, starting, etc.

Ignition systems, fuel pump, fuel injectors, fuel filters. Governing of I.C. engines, i.e. quality and quantity governing, necessity of cooling of I.C. engines, and their types.

Unit-3: Refrigeration and Air Conditioning **5 Hours**

Fundamentals of refrigeration systems, COP, Ton of refrigeration, Heat Pump, Verification of 2^{nd} law of thermodynamics, Vortex tube refrigeration, Non conventional refrigeration systems-Vapour absorption refrigeration system, thermoelectric refrigeration system, Steam jet refrigeration system etc. (Numerical treatment), Introduction to Air conditioning.

Unit-4: Vapour Power Cycles **8 Hours**

Carnot cycle using steam, ideal Rankine cycle, modified Rankine cycle, Reheat and Regenerative cycles with bleeding of steam, thermal efficiency, specific steam consumption, work ratio, power output, effect of superheat, inlet pressure and back pressure on performance of Rankine cycle (Numerical Treatment)

Unit-5: Steam Condensers **3 Hours**

Classifications, comparison between Jet and Surface condensers, vacuum, vacuum efficiency, vacuum measurement, mass of circulating water required in a condenser, air removal, capacity of air extraction pumps, introduction to cooling towers (Descriptive Treatment)

Reference Books

1. Rajput R.K., "A Text Book of Engineering Thermodynamics", Laxmi Publication, New Delhi
2. Eastop T D, McConkey A, "Applied Thermodynamics", Pearson education, New Delhi
3. Rajadurai J S, "Thermodynamics and Thermal Engineering", New Age Publishers, N. Delhi
4. Domkundwar & Domkundwar, "Introduction to Thermal Power Engineering", Dhanpatrai and Sons, New Delhi
5. Granet, Bluestein, "Thermodynamics and Heat Power", Pearson education, New Delhi
6. Radhakrishnan, "Fundamentals of Engineering Thermodynamics", PHI

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ME254: STRENTH OF MATERIALS

Teaching Scheme
Lectures: 3 hrs/week
Tutorial: 1 hr/week

Examination Scheme
Class Test – 20 marks
Teacher's Assessment –20 marks
End Sem Exam – 60 marks

Objectives:

1. To know the behavior of material at various in compression and tension
2. Understand and analyze shear force and bending moment in various loading conditions
3. To know the phenomenon of bending of different sections and its analysis and recognize principle stresses
4. To understands various columns sections and geometrical analysis
5. Concepts of strain energy, torsion and numerical analysis

Outcomes:

1. To apply compression and tension test results to understand stress, strain, young's modulus etc.
2. To develop SFD and BMD for various conditions
3. To apply the knowledge of bending concept to determine various stresses
4. Enhance the knowledge of columns conditions and develop numerical ability
5. Apply use of strain energy in failure modes of material

Unit – 1: **6 Hours**

Simple Stresses and Strains: Elasticity, Stress, Strain, Hook's Law, Young's Modulus, numerical on stresses in bar of varying sections and composite bars, numerical on statically indeterminate problems, thermal stresses and strains, numerical on thermal stresses in bars of varying sections and composite bars, numerical, elastic constants, bulk modulus, shear modulus, relation between bulk modulus, shear modulus and Young's modulus, numerical

Unit – 2: **6 Hours**

Shear Force and Bending Moment: Definition of shear force and bending moment, relation between SF, BM and intensity of loading, numerical on statically determinate beams (simply supported, cantilever, overhanging) subjected to point load, UDL, UVL, Couple

Unit – 3: **6 Hours**

a) **Stress in beams:** Theory of simple bending, assumptions, neutral axis, moment of resistance, section modulus, bending stress distribution diagram, numerical on statically determinate beams of rectangular and I section beams, section consisting of different materials, Shear stresses in beams

b) **Principal stresses and Strains:** Tangential and normal stresses, Principal Planes, principal stresses, analytical and graphical methods to find stresses on an oblique section

Unit – 4: **6 Hours**

a) **Columns & Struts:** Euler's theory and Rankin's theory of column failure with different support conditions, derivations, radius of gyration, slenderness ratio, factor of safety, numerical on single and built up cross sections.

b) **Direct and Bending Stresses:** Eccentric loading, symmetrical and unsymmetrical columns with eccentric loading about one and two axis, limit of eccentricity, core of section, numerical on stresses in rectangular, circular, hollow, built up column sections.

Unit – 5: **6 Hours**

a) **Strain Energy:** Definition, resilience, Proof resilience, Modulus of resilience, strain energy stored in the body due to gradually applied loads, suddenly applied loads and impact loads, strain energy due to shear, bending

b) **Theory of torsion:** Theory of torsion, assumptions, torsional stresses and strains numerical on solids hollow circular shafts, composite shafts and varying sections.

c) **Thin cylinders and spherical shells:** Thin cylinders and spherical shells subjected to internal fluid pressure, derivations, numerical on stresses induced in the sections due to internal fluid pressure

Reference:

1. "Strength of Material", S. Ramamrutham, Dhanpat Rai and sons
2. "Strength of Material", I.B. Prasad, khanna publication
3. "Strength of Material", Paytal and Singer, published by Harper Collins publications
4. "Strength of Material", B.C. Punmia, Standard publisher and distributors
5. "Strength of Material", William Nash, Schaum Series

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ME255: MACHINE TOOLS

Teaching Scheme
Lectures: 3 hrs/week

Examination Scheme
Class Test – 20 marks
Teacher's Assessment – 20 marks
End Sem Exam – 60 marks

Objectives:

1. To understand terminology and geometry of tools and various operations on lathe
2. To understand various milling operations
3. To understand operations carried out on drilling, boring and broaching machines
4. To understand operations carried out on grinding machines
5. To understand various non traditional machining processes

Outcomes: - Students will be able to

1. Select the correct tool for the particular machining operation on lathe
2. Enhance the knowledge of indexing process on milling machine and gear cutting
3. Acquire the knowledge of operations carried on drilling, boring and broaching machines
4. Acquire the knowledge of grinding operations
5. Understand practical aspects of non traditional machining

Unit – 1: Metal Cutting and Cutting Tools & Lathe **6 Hours**

Introduction, types of cutting tools, orthogonal and oblique cutting, types of chips, chip breakers, cutting tool nomenclature, cutting action of hand tools, cutting feed and speed, friction and heat sources in cutting, tools life and wear, machinability, cutting tool materials, cutting fluids, economics of machining.

Lathe- Turning on lathes, traditional lathes, capstan and turret lathes, automatic lathes

Unit – 2: Milling Machine **6 Hours**

Types of milling machines, milling cutters, indexing and dividing heads, indexing methods, calculations of indexing, multi-axis milling, Gear cutting methods, gear hobbing

Unit – 3: Drilling, Boring and Broaching machines **6 Hours**

Drilling- Introduction, types of drill, twist drill nomenclature, types of drilling machines, work holding devices, tool holding devices, drilling machine operation, speed, feed and machine time, Boring- Introduction, classification of boring machines, boring bars, boring heads, boring defects, Broaching- Introduction, principle parts of broach, broaching machines, application of broach, advantages of broaches, limitations of broaches and broaching tools

Unit – 4: Grinding Machines **6 Hours**

Introduction, grinding wheels, manufacturing of artificial abrasives, bonds and bonding processes, grit, grade and structure of grinding wheels, types of wheels, method of specifying grinding wheel, selection of grinding wheels, dressing and truing of grinding wheels, types of grinding machines

Unit – 5: Non Traditional Machining **6 Hours**

Introduction, classification of machining processes, abrasive jet machining (AJM), ultra sonic machining (USM), Chemical machining (CHM), electrochemical machining (ECM), Electrochemical grinding (ECG), electro discharge machining (EDM), electron beam machining (EBM), laser beam machining (LBM), plasma arc machining (PAM), ion beam machining

Reference Books

1. H. Gerling, "All about Machine Tools", Wiley Eastern
2. Krar S. F., "Technology of Machine Tools", Mc Graw Hill
3. G. Boothroyd, "Fundamentals of Metal Machining and Machine Tools", CRC press
4. Raghuvanshi B.S., "Workshop Technology", Vol I, Dhanpat Rai & Co., New Delhi
5. Hazra Choudhary, "Elements of Workshop Technology", Vol I, Dhanpat Rai Pub., New Delhi
6. Jain R.K., "Production Technology", Khanna Publications, New Delhi
7. Bawa H.S., "Workshop Technology", Vol I, Mc Graw Education, New Delhi

ME256: LAB - ELECTRICAL MACHINES

Teaching Scheme
Practical: 2 hrs/week

Examination Scheme
Term work: 50 marks

Objectives: Acquiring practical knowledge of electrical machines
Outcomes: Hands on experience of various electrical machines

Term Work

Term work shall consist of minimum eight experiments from the following

List of experiments:

1. Speed Control of DC Shunt Motor
2. Magnetization Characteristics of DC Generator
3. Load Characteristics of DC Generator
4. Load Test on 3-phase Induction Motor
5. Determination of regulation of 3-phase alternator by synchronous Impedence method and MMF method
6. Determination of regulation of 3-phase alternator by direct loading
7. Plotting of V and inverted V curves of synchronous motor
8. Study of alternator in different power station
9. Effect of variation of applied voltage on performance of IM and torque slip characteristics
10. Load test on three phase induction motor
11. Circle diagram & determination of various parameters of equivalent circuit of 3-phase IM
12. Determination of equivalent circuit parameters of single phase induction motor
13. Study of Stepper Motor
14. Study of Servomotor
15. Study of permanent magnet DC motor
16. Study and report submission by industrial visit to power stations.

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ME257: LAB – MECHANISMS OF MACHINES

Teaching Scheme
Practical: 2 hrs/week

Examination Scheme
Term work: 25 marks
Practical / oral: 25 marks

Objectives: To understand the practical application of various principles of kinematics of machines
Outcomes: Will be able to develop conceptual knowledge and appropriate application about mechanisms

Following experiments shall be conducted during the course and record (Journal) for the same should be submitted:
1. Demonstration of Kinematics of Mechanisms and Machines
2. Demonstration of Lower Pair Mechanism, such as Straight line generators, Pantograph, Steering Mechanism, Hooks joint
3. Draw sheets based on Velocity analysis problems (Three or four Problems)
4. Draw sheets based on Acceleration analysis (Three or four Problems)
5. Draw sheets based on Kinematic analysis – Short cut methods (Three or four Problems)
6. Draw sheet based on Graphical synthesis of cams, theory, classification, application, terminology etc
7. Draw sheet to generate Involute tooth profile with the help of a rack on gear blank
8. Demonstration of interference and undercutting for gear

Term work

The term work will consist of submitting a file for the experiments conducted with neatly written records of the study and diagrams
The term work will be assessed by the course coordinator

Practical Examination

The Practical Examination will comprise of Viva-voce based on term work and on the syllabus
The practical will be assessed by two examiners, one will be the course coordinator and other will be examiner appointed by DSB

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ME258: LAB – APPLIED THERMODYNAMICS

Teaching Scheme
Practical: 2-hrs/week

Examination Scheme
Term work: 25 marks
Practical / oral: 25 marks

Objectives: Acquiring practical knowledge of thermodynamic applications.
Outcomes: Enhancing practical knowledge about various thermodynamic applications.

Any eight experiments from the following list should be conducted during the course and record for the same should be submitted:

1. Trial on two stage Reciprocating air Compressors
2. Determination of efficiency of blower.
3. Study of Carburetors.
4. Study of Ignition Systems.
5. Study of fuel pump.
6. Study of domestic refrigerator.
7. Study of surface condenser
8. Study of cooling towers.
9. Visit to industry.

Term work

The term work will consist of submitting a file for all the experiments with neatly written records of the study and diagrams.
The term work will be assessed by the course coordinator

Practical Examination

The Practical Examination will comprise of performing the experiment and viva voce on the syllabus
The practical will be assessed by two examiners, one will be the course coordinator and other will be examiner appointed by DSB

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ME259: LAB – STRENGTH OF MATERIAL

Teaching Scheme
Practical: 2-hrs/week

Examination Scheme
Term work: 25 marks
Practical: 25 Marks

Objectives: To know the behavior of material under tension, shear, torsion, flexural and Impact test
Outcomes: To apply test knowledge to define and understand different material behavioral concept

Term work

The term work shall consist of performing following experiments. The candidates shall submit a report of each experiment and assignments. List of Experiments

1) Tension test on mild steel
2) Flexural test on timber
3) Shear test on metals (Direct and punching)
4) Impact test on metals
5) Hardness test on metals (Brinell and Rockwell)
6) Torsion test on solid shafts

Practical / Oral Examinations

Viva – voce based on the Term work, syllabus, and Assignment submitted.

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ME260: WORKSHOP PRACTICE – IV

Teaching scheme
Practical: 2 hrs/week

Examination Scheme
Term work: 25marks
Practical: 25marks
(Duration: 6 Hours)

Objectives: To acquire the hands on experience and skills for various operations like pattern making, moulding, sheet metal working and CNC Machining

Outcomes: Enhancing the skills in operations like pattern making, moulding, sheet metal working and CNC Machining

1. Pattern Making Shop: Study of pattern materials, types of patterns and cores, allowances, pattern making tools and allowances, safety precaution etc.

Job: Preparing at least one pattern in wood, involving details like, allowances, core prints, parting line of multi piece patterns etc.

2. Foundry Shop: Sand moulding, types of sands, preparing sand for moulding, equipments, sand moulds (cope, drag, check etc.), safety precaution etc.

Job: preparing sand moulds for single, multi-piece pattern in at least two or multi-piece moulding boxes and details like runners, risers, gates etc mould cavity finishing, demonstration of casting using ferrous of non-ferrous metal.

3. Sheet Metal Working Shop: Cutting operations (cut off, blanking, piercing etc) forming operations (blending, ribbing, corrugating etc) drawing operations, study of development of surfaces, safety precaution etc.

Job: Preparing a job individually or in a group of students of any useful item of daily use using various sheet metal working operations. Jobs for development of surfaces like pipe bend, elbow U shape, ducts etc.

4. CNC Shop: Study of different operations to be carried out on the CNC lathe machine using tail Stock, taper turning methods (calculations), internal cutting tool operations, internal threading, Facing, finishing cuts, CNC milling, Non-conventional machining processes, safety precaution etc.

Job: Preparing at least one job on CNC lathe machine CNC milling machine with programming and different operations etc. Individually or in a group individually or in a group

Term Work

The term work will consist of submitting a file for all the shops with neatly/written records of the study and diagrams. A workshop diary should be maintained by the students to record the progress of the jobs done

The term work will be assessed by the course coordinator

Practical Examination

The Practical Examination will comprise of two jobs in any two shops. The jobs should involve all the operations studied during the semester. Duration will be three hours for each job. Question paper will be set for all four shops.

The jobs will be assessed by two examiners, one will be the course coordinator and other will be examiner appointed by DSB.

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