TEACHING AND EXAMINATION SCHEME
FOR DIPLOMA **II Year MECHANICAL (AUTOMOBILE) ENGINEERING**
SESSION – 2009-2010 & ONWARDS
Third Semester

Code No.	Subjects	Distribution of Time				Distribution of Max. Marks/ Duration							Total Marks
		Hours per week				University's Exam.				Sessionals			
		L	T	P	Tot	TH	Hrs.	PR	Hrs.	CT	TU	PR(S)	
*MA 31	Strength of Materials – I	2	2/2	2	5	70	3	--	--	30	25	25	150
*MA 32	Fluid Mechanics – I	2	2/2	2	5	70	3	50	3	30	25	25	200
*MA 33	Manufacturing Process – I	4	--	2	6	70	3	--	--	30	--	50	150
*MA 34	Thermal Engineering – I	3	--	2	5	70	3	--	--	30	--	50	150
*MA 35	Materials and Material Science	2	--	2	4	70	3	--	--	30	--	50	150
MA 36	Auto Chassis and Body	3	--	2	5	70	3	--	--	30	--	50	150
*MA 37	Machine Drawing	--	--	6	6	--	--	50	3	--	--	100	150
	Total	16	2	18	36	420		100	--	180	50	350	1100
												Grand Total:	**1100**

1. L:Lecture
2.T:Tutorial
3.P:Practical
4.TH:Marks for University Examination for Theory
5.PR: Marks for University's Examination for Practicals
6.CT:Marks for Class Tests
7TU:Marks for Tutorials
8.PR(S):Marks for Practical and Viva

*MA 31 Same as AR 31/CE 31/ME 31/MP 31 * MA 32 Same as CE 32/ME 32 *MA 33 Same as ME 33/MP 33
*MA 34 Same as ME 34 * MA 35 Same as ME 35 *MA 37 Same as ME 37

TEACHING AND EXAMINATION SCHEME
FOR DIPLOMA **II Year MECHANICAL (AUTOMOBILE) ENGINEERING**
SESSION – 2009-2010 & ONWARDS
Fourth Semester

Code No.	Subjects	Distribution of Time				Distribution of Max. Marks/ Duration							Total Marks
		Hours per week				University's Exam.				Sessionals			
		L	T	P	Tot	TH	Hrs.	PR	Hrs.	CT	TU	PR(S)	
*MA 41	Strength of Materials – II	2	2/2	2	5	70	3	--	--	30	25	25	150
*MA 42	Fluid Machines	2	2/2	2	5	70	3	--	--	30	25	25	150
MA 43	Auto Engine-Components & Performance	2	2	--	4	70	3	--	--	30	50	--	150
MA 44	Auto Engine	3	--	2	5	70	3	50	3	30	--	50	200
*MA 45	Workshop Technology – I	2	--	6	8	70	3	50	3	30	--	50	200
*MA 46	Metrology	2	--	2	4	70	3	--	--	30	--	50	150
*MA 47	Theory of Machines	3	2	--	5	70	3	--		30	50	--	150
	Total	16	6	14	36	490		100	--	210	150	200	1150
												Grand Total:	**1150**

1. L:Lecture
2.T:Tutorial
3.P:Practical
4.TH:Marks for University Examination for Theory
5.PR: Marks for University's Examination for Practicals
6.CT:Marks for Class Tests
7TU:Marks for Tutorials
8.PR(S):Marks for Practical and Viva

*MA 41 Same as CE 41/ME 41
*MA 42 Same as ME 42
*MA 45 Same as ME 45
*MA 46 Same as ME 46
*MA 47 Same as ME 47

TEACHING AND EXAMINATION SCHEME
FOR DIPLOMA **III Year MECHANICAL (AUTOMOBILE) ENGINEERING**
SESSION – 2009-2010 & ONWARDS
Fifth Semester

Code No.	Subjects	Distribution of Time				Distribution of Max. Marks/ Duration							Total Marks
		Hours per week				University's Exam.				Sessionals			
		L	T	P	Tot	TH	Hrs.	PR	Hrs.	CT	TU	PR(S)	
MA 51	Industrial Engg. and Transport Management	3	2/2	--	4	70	3	--	--	30	50	--	150
MA 52	Auto Shop Practice	--	--	6	6	--	--	50	3	--	--	100	150
MA 53	Auto Electric Equipments	3	--	2	5	70	3	--	--	30	--	50	150
MA 54	Auto Design – I	2	2	--	4	70	3	--	--	30	50	--	150
*MA55	Workshop Technology – II	3	--	6	9	70	3	50	3	30	--	50	200
MA 56	**Elective – I**												
	*MA 561 Power Plant Engineering	3	2/2	--	4	70	3	--	--	30	50	--	
	MA 562 Electrical and Electronics Engineering	2	--	2	4	70	3	--	--	30	--	50	
	MA 563 Automobile Air Conditioning	2	--	2	4	70	3	--	--	30	--	50	150
MA 57	**Elective – II**												
	*MA 571 'C' Programming	2	--	2	4	70	3	--	--	30	--	50	
	*MA 572 Computer in Business Systems	2	--	2	4	70	3	--	--	30	--	50	150
	Practical Training (24 Working Days)							100					100
											Grand Total:		**1200**

*MA 55 Same as ME 55
*MA 561 Same as ME 561
*MA 571 Common for All Branches of Engineering except CS & IT
*MA 572 Common for All Branches of Engineering

TEACHING AND EXAMINATION SCHEME
FOR DIPLOMA **III Year MECHANICAL (AUTOMOBILE) ENGINEERING**
SESSION – 2009-2010 & ONWARDS
Sixth Semester

Code No.	Subjects	Distribution of Time				Distribution of Max. Marks/ Duration							Total Marks
		Hours per week				University's Exam.				Sessionals			
		L	T	P	Tot	TH	Hrs.	PR	Hrs.	CT	TU	PR(S)	
MA 61	Advance Auto Chassis and Body	3	--	3	6	70	3	--	--	30	--	50	150
MA 62	Auto Garage Practice	--	--	6	6	--	--	50	3	--	--	100	150
*MA63	Manufacturing Process – II	3	--	3	6	70	3	50	3	30	--	50	200
MA 64	Auto Design – II	2	2	--	4	70	3	--	--	30	50	--	150
MA 65	Auto Drawing and Computer Aided Drafting	2	--	4	6	70	3	50	3	30	--	50	200
MA 66	**Elective – III**												
	*MA 661 Mechanical Estimating and Costing	2	2	--	4	70	3	--	--	30	50	--	
	*MA 662 Renewable Energy Sources	3	2/2	--	4	70	3	--	--	30	50	--	150
MA 67	**Elective – IV**												
	*MA 671 Management	2	2	--	4	70	3	--	--	30	50	--	
	*MA 672 Entrepreneurship Development	2	2	--	4	70	3	--	--	30	50	--	
	*MA 673 Production System Management	2	2	--	4	70	3	--	--	30	50	--	150
	Project (24 Working Days)							100					100
											Grand Total:		**1250**

*MA 63 Same as ME 63
*MA 661 Same as ME 661
*MA 662 Same as ME 662
*MA 671/MA 672/ MA 673 Common for All Branches of Engineering

STRENGTH OF MATERIALS - I

CODE MA 31	L	T	P
AR 31/CE 31/ME 31/MP 31	2	2/2	2

RATIONALE

In Engineering every structure or machine element is designed for a particular application. Then it is tested. A Diploma holder should be capable of designing the various elements for particular requirements. For this he must be able to calculate the stresses in an elements and their nature.

CONTENTS

1. Simple Stress and Strain :

1.1 Various mechanical properties

- 1.1.1 Elasticity
- 1.1.2 Plasticity
- 1.1.3 Ductility
- 1.1.4 Brittleness
- 1.1.5 Toughness
- 1.1.6 Hardness

1.2 Concept of stress and strain

- 1.2.1 Type of force - Direct, shear
- 1.2.2 Stress - Tensile, compressive, shear

1.3 Hook's law

- 1.3.1 Statement of Hook's law
- 1.3.2 Young's modulus of elasticity
- 1.3.3 Tensile test diagram
  - 1.3.3.1 Gauge length
  - 1.3.3.2 Limit of proportionality
  - 1.3.3.3 Elastic limit
  - 1.3.3.4 Yield point, Yield strength
  - 1.3.3.5 Ultimate stress
  - 1.3.3.6 Rupture strength
  - 1.3.3.7 Nominal stress
  - 1.3.3.8 Proof stress

1.4 Working stress and factor of safety

1.5 Stress and strain calculations

- 1.5.1 Principle of superposition
- 1.5.2 Bar of homogeneous section
  - 1.5.2.1 Bar of uniform cross-section
  - 1.5.2.2 Bar of steeped cross-section
- 1.5.3 Bar of composite section

1.6 Temperature stresses

- 1.6.1 Homogeneous section
- 1.6.2 Composite section

1.7 Shear stresses

- 1.7.1 Modulus of rigidity
- 1.7.2 Complementary shear stress
- 1.7.3 Concept of single shear and double shear
- 1.7.4 Shear strain

1.8 Poisson's ratio and volumetric strain

- 1.8.1 Lateral strain
- 1.8.2 Longitudinal strain
- 1.8.3 Volumetric strain
- 1.8.4 Bulk modulus

1.9 Relationship between elastic constants (Derivation)

- 1.9.1 E=3K(1-2/m)
- 1.9.2 E=2N(1+1/m)
- 1.9.3 E=9KN/(3K+N)

2. Compound Stress :

2.1 Introduction
2.2 Stress components on an inclined plane

- 2.2.1 Induced by direct stresses
- 2.2.2 Induced by simple shear
- 2.2.3 Induced by direct and simple shear stresses

2.3 Mohr's circle :

- 2.3.1 For like direct stresses
- 2.3.2 For unlike direct stresses
- 2.3.3 For two perpendiculars direct stresses with state of simple shear

2.4 Principal stresses and planes

- 2.4.1 Major principal stress
- 2.4.2 Minor principal stress
- 2.4.3 Mohr's circle method for principal stresses

3. Strain Energy :

3.1 Introduction
3.2 Strain energy from stress - strain diagram
3.3 Proof resilience
3.4 Types of loading - gradual, sudden, impact

- 3.4.1 Stress in gradual loading
- 3.4.2 Stress in sudden loading
- 3.4.3 Stress in impact loading

4. Bending Moments and Shear Force :

4.1 Basic concept

- 4.1.1 Types of support
  - 4.1.1.1 Movable hinge support (roller)
  - 4.1.1.2 Immovable hinge support
  - 4.1.1.3 Fixed support
- 4.1.2 Types of beam

4.1.2.1 Cantilever beam
4.1.2.2 Simply supported beam
4.1.2.3 Fixed beam
4.1.2.4 Continuous beam
4.1.2.5 Overhanging beam

4.1.3 Types of load

4.1.3.1 Point load
4.1.3.2 Distributed load - uniformly and non uniformly

4.2 Shear force and bending moment

4.2.1 Concept and calculation of shear force and bending moment
4.2.2 Sign convention for shear force and bending moment

4.3 Bending moment and shear force diagrams (for point loads, U.D.L. and their combinations)

4.3.1 Cantilever beam
4.3.2 Simply supported beam
4.3.3 Simply supported beam with over hang

5. Moment of Inertia :

5.1 Concept of moment of Inertia
5.2 Radius of gyration

5.2.1 Parallel axis theorem
5.2.2 Perpendicular axis theorem

5.3 Moment of Inertia of various section

5.3.1 Rectangle
5.3.2 Triangle
5.3.3 Circle

5.4 Moment of inertia of unsymmetrical section like : T-section, channel section, L-section etc.

6. Bending Stresses in Beams :

6.1 Concept of bending stress
6.2 Theory of simple bending

6.2.1 Assumptions in theory of simple bending
6.2.2 Use of equation $\frac{M}{I} = \frac{f}{y} = \frac{E}{R}$ (without proof)

6.3 Design criterion and section modulus

6.3.1 Section modulus
6.3.2 Calculation of max bending stress in beams of rectangular, circular, I and T section

7. Shear Stress in Beams :

7.1 Concept

7.2 Use of equation $q = \frac{F}{Ib}(A\bar{y})$ (without proof)

7.3 Shear stress distribution diagram of various sections

7.3.1 Rectangle
7.3.2 I section

7.3.3 T section
7.3.4 Channel section
7.3.5 H section
7.3.6 + section
7.3.7 Circular section

PRACTICALS

1. Study of extensometers
2. Study and operation of UTM
3. Tensile test on mild steel specimen and plotting stress strain curve.
4. Bending test on timber beams.
5. Compression test on common structural materials viz. timber, cast iron etc.
6. Determination of toughness of cast iron and mild steel specimen by Charpy and Izod test.
7. Hardness test by Brinell and Rockwell test.

REFERENCE BOOKS :

1.	Strength of Materials & Theory of Structures (vol. I)	B.C.Punmia
2.	Strength of Materials	Ramamurtham
3.	Strength of Materials	Junarkar
4.	Strength of Materials	R.S. Khurmi
5.	Strength of Materials (Hindi)	Gurcharan singh

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FLUID MECHANICS - I

CODE MA 32	L	T	P
CE 32/ME 32	2	2/2	2

RATIONALE

Technicians have to deal with pressure measurement, transportation of fluids and the machines converting hydraulic power into mechanical power and vice versa, in the field/industries for that one has to have a basic knowledge of fluid mechanics. Topics such as pressure measurement, laws governing the flow of liquids, measurement of discharge, production of power are included in this subject.

Although the major emphasis in this subject is on the study of liquids like water an incompressible fluid yet all the principles are applicable to all the fluids such as air, gas, steam etc.

CONTENTS

1. Introduction :

- 1.1 Introduction concepts
  - 1.1.1 Fluids and solids
  - 1.1.2 Liquid, gas and vapour
- 1.2 Fluid mechanics
  - 1.2.1 Kinematics
  - 1.2.2 Dynamics
- 1.3 Fluid properties
  - 1.3.1 Density
  - 1.3.2 Specific volume
  - 1.3.3 Specific gravity
  - 1.3.4 Viscosity
    - 1.3.4.1 Newton's law of Viscosity
    - 1.3.4.2 Dynamic and Kinematic Viscosity
  - 1.3.5 Compressibility
  - 1.3.6 Surface tension - soap bubble, drop
  - 1.3.7 Capillarity
  - 1.3.8 Vapour pressure and its importance

2. Fluid Pressure and its Measurement :

- 2.1 Definition and its units
- 2.2 Pascal's law
  - 2.2.1 Intensity of pressure at a point in fluid at rest
  - 2.2.2 Pressure head
- 2.3 Pressure
  - 2.3.1 Atmospheric pressure
  - 2.3.2 Gauge pressure
  - 2.3.3 Vacuum pressure
  - 2.3.4 Absolute pressure
  - 2.3.5 Differentials pressure
- 2.4 Law of hydrostatic pressure
- 2.5 Brahma's press
- 2.6 Pressure measurement

2.6.1 Manometers

2.6.1.1 Piezometer - its limitation
2.6.1.2 U-tube - simple, differential, inverted
2.6.1.3 Micro-manometers
2.6.1.4 Inclined tube micro-manometers

2.6.2 Mechanical gauge

2.6.2.1 Bourdon gauge
2.6.2.2 Bellow gauge
2.6.2.3 Diaphragm gauge
2.6.2.4 Dead weight gauge

3. Hydrostatics :

3.1 Total pressure
3.2 Centre of pressure
3.3 Total pressure and center of pressure in following cases

3.3.1 Plane surface immersed horizontally
3.3.2 Plane surface immersed vertically
3.3.3 Plane surface immersed at an angle
3.3.4 Curved surface (no proof)

3.4 Working of lock gates, sluice gate
3.5 Pressure on masonry dams of rectangular and trapezoidal sections and their condition of stability

4. Hydrokinematics :

4.1 Description of fluid flow

4.1.1 Eular approach
4.1.2 Lagrangian approach

4.2 Definition of path line, stream line
4.3 Types of flow

4.3.1 Steady - Non steady
4.3.2 Uniform - Non uniform
4.3.3 Laminar - Turbulent
4.3.4 One, Two, Three dimensional flow

4.4 Continuity equation (no proof) :

4.4.1 Assumption
4.4.2 Rate of discharge
4.4.3 For one dimensional flow

5. Hydrodynamics and Measurement of Flow :

5.1 Energy of fluid - pressure, kinetic and potential
5.2 Bernoulli's theorem (no proof)

5.2.1 Assumptions and its limitation
5.2.2 Conversion of pressure into pressure head, velocity into kinetic head

5.3 Applications of Bernoulli's theorem

5.3.1 Pitot-tube
5.3.2 Venturimeter
5.3.3 Orificemeter

6. Orifices and Notches :

6.1 Definition and classification
6.2 Discharge through small orifices

6.2.1 Coefficient of contraction
6.2.2 Coefficient of velocity
6.2.3 Coefficient of discharge
6.2.4 Coefficient of resistance

6.3 Time of emptying a vessel of uniform cross section through an orifice at bottom.

6.4 Notches - Classification

6.4.1 Crest, Nappe
6.4.2 Difference between notch and weir

6.5 Flow over -

6.5.1 Triangular notch
6.5.2 Rectangular notch
[Simple numerical problems without velocity of approach]

PRACTICALS.

1. Study of different types of manometers and pressure gauges
2. Verification of Bernoulli's theorem
3. Determination of C_d for Venturimeter
4. Determination of C_d for Orificemeter
5. Determination of C_c,C_v and C_d of small orifice
6. Visit of a near by dam

REFERENCE BOOKS :

1. Fluid Mechanics & Machines Dr. Jagdish Lal
2. Fluid Mechanics & Machines Dr. R.K.Bansal
3. Fluid Mechanics & Machines R.S.Khurmi.
4. Hydraulics & Pneumatics H.L. Stewart.

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MANUFACTURING PROCESS - I

CODE MA 33	L	T	P
ME 33/ MP 33	4	--	2

RATIONALE

This subject provides an opportunity to the student to learn about various welding processes and foundry work. Welding is very useful for fabrication work and Foundry for production of castings used for manufacturing of machines. This also gives knowledge of metal cutting mechanism to the student. Theory is to be supported by visits to industries and case studies. This will help in developing proper attitude and skill to the technicians. Hence the technicians will be in a position to help and solve the problems of industry.

CONTENTS

1. Welding Process :

1.1 Classification of welding process, Industrial applications of welding.

2. Gas Welding :

2.1 Principle of oxy-acetylene gas welding, Construction of oxy- acetylene cutting torch and gas welding torch
2.2 Blowpipes, single stage and double stage regulators.
2.3 Gas cutting (oxy-acetylene), lance cutting, flames gauging, grooving

3. Electric Welding Process :

3.1 Difference between A.C and D.C arc welding, Equipments and accessories of A.C and D.C welding plants
3.2 Effect of polarity, length of arc, penetration, crater, arc blow
3.3 Electrodes (Metal and Carbon), B.I.S specification for welding Symbols and electrodes, Flux and their functions
3.4 Resistance welding

3.4.1 Spot welding, butt welding, flash welding
3.4.2 Seam welding, percussion welding and projection welding

3.5 Atomic hydrogen welding
3.6 Shielded metal arc welding, Submerged arc welding
3.7 Pressure welding
3.8 Welding distortion, welding defects, method of controlling welding defects and inspection of welded joints

4. Modern Welding Methods :

4.1 Tungsten inert gas welding (TIG)

4.1.1 Principle of operation, advantage, disadvantages, application

4.2 Metal inert gas welding (MIG)

4.2.1 Principle of operation, advantage, disadvantages, application

4.3 Thermit welding
4.4 Electroslag welding, Electron beam welding
4.5 Ultrasonic welding, Laser beam welding
4.6 Robotic welding

5. Pattern Making :

5.1 Introduction to materials - timber, metal, plastics and plaster of Paris etc.
5.2 Allowances- shrinkage, draft, machining, distortion and shake

6. Types of Pattern :

6.1 Solid, Split loose piece, match plate
6.2 Sweep, Gated, Skeleton, segmental, follow board, colour code for patterns as per B.I.S.

7. Moulding Sand Ingredients :

7.1 Moulding sands-green, dry, loam, facing, baking, parting and core sands.
7.2 Silica grain, binders, additive, moisture
7.3 Properties of molding - sand, permeability, refractoriness, adhesiveness, cohesiveness, strength, flowability, collapsibility
7.4 Tempering, sand conditioning and sand muller.

8. Core and Core Making :

8.1 Core, core print and core boxes
8.2 Types of cores, functions, advantage of core, shrinkage of cores
8.3 Core sand and binders, core loams, oil and CO_2 cores, synthetic resin
8.4 Core Making procedure, core oven and core baking.

9. Testing of Moulding Sands :

9.1 Need for testing chemical analysis, moisture content test, clay content test, Grain fineness test
9.2 Permeability test and strength test.

10. Mould Making :

10.1 Moulding boxes, hand tools used for mould making
10.2 Steps involved in making a mould, gating system: definition and brief idea of basin, sprue, runner and gates
10.3 Moulding machines - Squeeze machine, jolt squeeze machine and sand slinger.
10.4 Moulding processes - Green sand, dry sand, loam, Co_2 moulding, skin dried, plaster, metal moulding

11. Special Casting Techniques :

11.1 Die casting - Hot chamber, cold chamber process
11.2 Investment or lost wax process
11.3 Centrifugal casting - True, Semi centrifugal, centrifugal
11.4 Shell moudling
Advantages, Disadvantages and application of above processes

12. Melting Furnaces :

12.1 Cupola furnace - Construction, operation, preparation, charging
12.2 Crucible furnace of tilting types - construction, operation

13. Castings :

13.1 Different types of defects
13.2 Testing of defects - Radiography, magnetic particle inspection, Ultrasonic inspection

PRACTICALS

1. Making following types of joints by gas welding :

1.1 Preliminary joining practice on gas welding
1.2 Vertical welding

2. Exercises of gas welding on the following

2.1 Aluminium welding
2.2 Brass welding
2.3 Copper welding
2.4 C.I. welding

3. Gas cutting of the following types

3.1 Preliminary gas cutting practice
3.2 Stock cutting by oxy acetylene
3.3 C.I. cutting

4. Making following types of joints by arc welding

4.1 Preliminary joining practice by arc welding
4.2 Butt and lap joint (in vertical position travel up and down)
4.3 Welding of outside corner joint

5. Exercise on spot welding
6. Exercise on brazing
7. Exercise on TIG/MIG/CO_2 welding
8. Pattern making :

8.1 Preparation of solid pattern (single piece)
8.2 Preparation of split pattern
8.3 Preparation of self cored pattern

9. Preparation of the following types of moulds .

9.1 Floor moulding
9.2 Turn over moulding.

10. Testing of moulding sand- moisture content
11. Moulding and casting of

11.1 A solid pattern
11.2 A split pattern

12. Testing and inspection of casting defects visually
Foundry exercise can be shown in a nearby industry/ foundry.

REFERENCE BOOKS :

1.	A Text Book of Welding Technology	O.P. Khanna
2.	Welding Technology	Tahil Maghnani
3.	A Text Book on Foundry Technology	M.Lal & O.P.Khanna.
4.	Foundry Engineering	Tahil Meghnani
5.	Manufacturing Process - I	R.K. Yadav

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THERMAL ENGINEERING - I

	L	T	P
CODE MA 34			
ME 34	3	--	2

RATIONALE

For technical education in mechanical engineering field the subject of thermal engineering is very important for under standing the basic principles and concept of thermodynamics and its application.

CONTENTS

1. Basic Concept and Gas Laws :

1.1 Thermodynamics, property-Intensive and Extensive, system - open, closed and isolated
1.2 Energy - Internal energy, potential energy, kinetic energy, heat, work, specific heat, enthalpy
1.3 Boyle's law, Charle's law, Joule's law
1.4 Characteristics gas equation, gas constant, mol, universal gas constant and molar specific heats
1.5 Simple numerical problems

2. Laws of Thermodynamics :

2.1 Zeroth law of thermodynamics
2.2 First law of thermodynamics.
2.3 Second law of thermodynamics Concept of entropy
2.4 Constant volume, constant pressure, isothermal, adiabatic polytropic processes, throttling and free expansion, work done during these processes.
2.5 Simple numerical problems

3. Availability :

3.1 Available and unavailable energy
3.2 Effectiveness
3.3 Irreversibility in flow and non-flow process.

4. Formation of Steam and its Properties :

4.1 Generation of steam at constant pressure, various stage of steam- wet steam, dry steam saturated steam, dryness fraction, super heated steam, degree of super heat.
4.2 Critical point, triple point, thermodynamic properties of steam - specific volume, specific enthalpy, specific internal energy, specific entropy.
4.3 Steam property diagram: temperature - entropy diagram, enthalpy- entropy diagram, pressure - enthalpy diagram
4.4 Heating and expansion of steam during thermodynamic processes, Change of internal energy and entropy of steam during processes
4.5 Simple numerical problems Use of steam tables and Mollier charts.

5. Steam Generators :

5.1 Definition of boiler according to I.B.R., classification of boilers, description and working of Lancashire, Cochran and Babcock and Wilcox boilers, Comparison of water tube and fire tube boilers.
5.2 Brief description and working of boiler mountings and accessories used in common boilers.
5.3 Special characteristics of high-pressure boilers, Structural details and working of Lamont, Benson and Schmidt Hartmann boilers
5.4 Introduction to Indian Boiler Act.

6. Boiler Performance :

6.1 Actual evaporation, Equivalent evaporation, Factor of evaporation, Boiler efficiency
6.2 Heat losses in boiler plants, Boiler power, Energy balance sheet of boiler.
6.3 Simple numerical problems

7. Vapour Power Cycle :

7.1 Rankine cycle, modified rankine cycle, representation on p-v, t-s and h-s charts and efficiency
7.2 Simple numerical problems

PRACTICALS

1. Study by models/charts/actual units of the following:

1.1 Common type of fire tube and water tube boilers.
1.2 Boiler mountings
1.3 Boiler accessories
1.4 High pressure boilers

2. Determination of dryness fraction of steam by separating and throttling calorimeter

REFERENCE BOOKS :

1. Thermal Engineering (Hindi) Verma & Gulecha
2. Thermal Engineering Vol.1 Mathur & Mehta .
3. Thermal Engineering R.K.Purohit.
4. Thermal Engineering R.S. Khurmi
5. Elements of Heat Engines -Vol.1 Patel & Karam Chandani

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MATERIALS AND MATERIAL SCIENCE

CODE MA 35	L	T	P
ME 35	2	--	2

RATIONALE

Lot of development has taken place in the field of materials. New materials are being developed. It has become possible to change the properties of materials to suit the requirements. Diploma holders in mechanical engineering are required to make use of different materials for various applications. For this purpose, it is necessary to teach them basics of metal structure, properties, usage and testing of various ferrous and nonferrous materials and various heat treatment processes. This subject aim at developing knowledge about characteristics, testing and usage of various types of materials used in mechanical engineering industry.

CONTENTS

1. Classification and Properties of Materials :

1.1 Introduction to engineering materials
1.2 Classification of materials
1.3 Thermal, chemical, electrical, mechanical properties of various materials
1.4 Selection criteria for use in industry

2. Structure of Metals and Their Deformation :

2.1 Metal structure
2.2 Arrangement of atoms in metals
2.3 Crystalline structure of metals
2.4 Crystal imperfections
2.5 Deformation of metal
2.6 Impact of cold and hot working on metal structure.

3. Ferrous Materials :

3.1 Classification of iron and steel
3.2 Sources of Iron ore and its availability
3.3 Manufacture of pig iron, wrought iron, cast iron and steel
3.4 Types of cast iron: white, malleable grey, mottled, nodular and alloy and their usage.
3.5 Classification of steels
3.6 Different manufacturing method of steel open hearth, bessemer, electric arc.
3.7 Specification as per BIS and equivalent standards
3.8 Effect of various alloying elements on steel
3.9 Use of alloy steel (high-speed steel, stainless steel, spring steel, silicon steel)

4. Non Ferrous Materials :

4.1 Important ores and properties of aluminium, copper, zinc, tin, lead
4.2 Properties and uses of nonferrous alloys

5. Engineering Plastics and Fibers :

5.1 Introduction of plastics
5.2 Classification - Thermoplastic and thermosetting
5.3 Various trade names of engineering plastics
5.4 Fibers and their classification : Inorganic and organic fibers
5.5 Uses of fiber

6. Insulating Materials :

6.1 Various heat insulating material and their usage like asbestos, glass, wool thermocole, cork, puf, china clay.
6.2 Various electrical insulating materials and their use.

7. Testing of Metals and Alloys :

7.1 Identification tests : appearance, sound, spark, weight, magnetic, band microstructure, filing

8. Fundamental of Heat Treatment :

8.1 Principles of heat treatment
8.2 Theory of solid solution
8.3 Iron-carbon diagram
8.4 TTT curve in steels and its importance
8.5 Basic idea about martenstic transformation
8.6 Various heat treatment processes - hardening, tempering, annealing, normalising, case hardening and surface hardening.
8.7 Types of heat treatment surfaces.

PRACTICALS

1. Classification of about 25 specimens of materials / parts into

1.1 Metals and non metals
1.2 Metals and alloys
1.3 Metals and non ferrous metals
1.4 Metals and non ferrous alloys

2. Given and set of specimen of metals and alloys (copper, brass, aluminium, cast iron HSS, Gun metal) : identify and indicate the various properties posseses by them

3. 3.1 Study of heat treatment furnace
3.2 Study of thermocouple / pyrometer

4. Study of a metallurgical microscope and a diamond-polishing machine.
5. To prepare specimens of following materials for microscopic examination and to examine the microstructure of the specimens of the following materials :
5.1 Brass
5.2 Copper
5.3 Grey CI
5.4 Malleable CI
5.5 Low carbon steel
5.6 High carbon steel
5.7 HSS

6. To temper a given specimen and find out difference in hardness (with the help of hardness tester) as a result of tempering.

REFERENCE BOOKS :

1. Engineering Material — B.K. Agarwal
2. Elements of Metallurgy — H.S. Bawa
3. Materials and Metallurgy Lab Manual — Adithan & Bahl
4. Material Science — R.K. Rajput

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AUTO CHASSIS AND BODY

CODE MA 36

L	T	P
3	--	2

RATIONALE

Knowledge of chassis layout, suspension system, braking system, wheel and tyres, frame and body, transmission, steering, steering gears and geometry is imparted in this syllabus.

CONTENTS

1. Introduction :

1.1 Classification of Automobiles
1.2 Chassis and body
1.3 Components of vehicle – basic structure, power unit, transmission system, accessories, superstructure.
1.4 Layout of conventional type vehicle (front engine rear wheel drive)
1.5 Basic functions and arrangements of various components.
1.6 Vehicle dimensions – wheel base, wheel track, front & rear overhang, overall dimensions, ground clearance.

2. Suspension System :

2.1 Basic functions of suspension system
2.2 Types - Independent and rigid, coil, leaf, torsion bar, air, rubber suspension (Elementary idea)
2.3 Conventional leaf spring rigid beam suspension for light vehicle and with helper spring for heavy vehicles. Suspension for Tandem axle
2.4 Fitting of spring assembly, shackles
2.5 Functions and types of shock absorbers, construction and working of hydraulic telescopic type shock absorber.
2.6 Sprung and unsprung weight.

3. Braking Systems :

3.1 Purpose, principle of braking, Stopping distance, layout of braking system components, Braking efficiency.
3.2 Classification of brakes, requirements of a good braking
3.3 Hydraulic brakes

3.3.1 Principle, layout of components
3.3.2 Construction & working of single and tandem master cylinder, wheel cylinder
3.3.3 Brake fluid and its characteristics

3.4 Brake drum, types materials
3.5 Brakes shoes, types and construction, steady ports, brake shoe adjuster.
3.6 Brakes lining – material, thickness, area brake pedal travel and clearance
3.7 Hand brakes

4. Wheels and Tyres :

4.1 Wheels

4.1.1 Requirements of wheel
4.1.2 Types- pressed steel disc, wire, light alloy cast wheels, advantages & disadvantages inset, outset, and zeroset, reversible and divided wheels
4.1.3 Rim- flat base (two piece and three piece) and well base rims

4.2 Tyres

4.2.1 Functions of tyres
4.2.2 Classification – solid, pneumatic, high low and extra low-pressure tyre, tubed and tubeless tyre, cross ply, belted bias and redial ply tyre.
4.2.3 Cross section of a pneumatic tyre
4.2.4 Specification of tyres

4.2.5 Desirable tyre properties

5. Frame and Body :

5.1 Frame

5.1.1 Function of frame, loads or frame
5.1.2 Frame construction, sub-frame
5.1.3 Defects in frame chassis repair and alignment
5.1.4 Frame less construction

5.2 Body

5.2.1 Types and construction (parts of body)
5.2.2 Main features – strength, stiffness, space air drag, stream lining , weight, vibration, protection against weather, corrosion, safety and economy considerations.
5.2.3 Body alignment
5.2.4 Bumpers – types and functions
5.2.5 Denting and painting
5.2.6 Window regulators, doors, hood, dash board, glass work.

6. Clutch :

6.1 Purpose and requirements of clutch
6.2 Type - Single plate, multi plate, dry, wet, semi centrifugal, centrifugal
6.3 Constructional and operation of conventional coil spring type clutch.
6.4 Construction of clutch plate, living material

7. Gear Box :

7.1 Functions and types of gear boxes
7.2 Constructional details and working of sliding mesh, constant mesh and synchronous mesh gear boxes
7.3 Different gear selector mechanism – constructions and working
7.4 Interlocking methods- constructions and working

8. Final Drive :

8.1 Function, types and constructional details of - Propeller shafts, Universal joints, Sliding joint
8.2 Differential - Principles, function, construction and working of conventional differential
8.3 Different types of rear axles according to methods of supporting.

9. Front axle and Steering System :

9.1 Front axle - types and construction, front wheel stub axle assembly
9.2 Purpose and requirements of steering system
9.3 General arrangement of steering systems steering gear ratio, variable steering ratio.
9.4 Steering system components – steering wheel, steering column, conventional steering linkage, steering and ignition lock
9.5 Construction and working details of different types of steering gear boxes

10. Upholstery :

10.1 Seats – location, mounting and adjustment
10.2 Seat belts – location fitting points and operation
10.3 Ceiling, side panels, door channels, beading and furnishing materials

PRACTICALS

1. Study of conventional layouts of vehicles.
2. Study and inspection of suspension system of light and heavy vehicles.
3 Study of hydraulic braking system and bleeding of hydraulic braking system
4. Complete study of conventional transmission system

4.1.1 Clutch
4.1.2 Gear box
4.1.3 Final drive

5. Study of frame and body of an automobile

5.1.1 Inspection of the frame and body
5.1.2 Repairing of the frame and body
5.1.3 Denting and painting practices

REFERENCE BOOKS :

1. Automotive Chassis & Body. P.L.Kohli.
2. Vehicle & Engine Technology (Vol. I & II) Heinz Heisler.
3. Basic Automobile Engineering C.P.Nakra.
4. Automobile Engineering. T.R.Banga & Nathu Singh.
5. Automobile Engineering H.S. Reyat
6. ऑटोमोबाइल अभियांत्रिकी एस.एम. पाण्डेय (दीपक प्रकाशन, म.प्र.)

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MACHINE DRAWING

	L	T	P
CODE MA 37			
ME 37	--	--	6

RATIONALE

In order to produce a good product, a neat drawing is a must. There fore technicians must be well acquainted with the knowledge of machine drawing. Machine drawing is the universal language of engineers and student must be made familiar with all the relevant aspect topics of machine drawing.

Subject contents various drawings of machine and components to clarify the manufacturing and construction details for the students.

CONTENTS

1. Coupling :

- 1.1 Split muff coupling
- 1.2 Universal coupling
- 1.3 Flexible bushed pin type

2. Bearings :

- 2.1 Types of bearings
- 2.2 Plumber block
- 2.3 Foot step bearing

3. Machine Components :

- 3.1 Machine vice
- 3.2 Tail stock of lathe
- 3.3 Shaper tool head

4. Valves :

- 4.1 Classification of valves
- 4.2 Valve seats
- 4.3 Steam stop valve
- 4.4 Feed check valve

5. I. C. Engine Components :

- 5.1 Piston and connecting rod assembly

6. Jigs and Fixtures :

- 6.1 Definitions
- 6.2 Types of jig, bushes
- 6.3 Drilling jigs
- 6.4 Types of fixtures

PRACTICALS

Preparation of assembly drawing sheets from detailed drawings :

1. Couplings
2. Plummer block and foot step bearing
3. Machine vice
4. Tail stock
5. Shaper tool head
6. Steam stop valve
7. Feed check valve
8. I.C. Engine connecting rod and piston
9. Drilling jig

Exercises for sketch book :

1. Jigs, Bushes and fixtures
2. Pulleys : Straight arm pulley, loose and fast pulley
3. Pipe fittings and pipe joints - Pipe fittings and their symbols, flanged pipe joint and spigot and socket joint

REFERENCE BOOKS :

1. Machine Drawing — Laxmi Narayanan & Mathur
2. Machine Drawing — P.S Gill
3. Machine Drawing — R.B.Gupta
4. Machine Drawing — Sidheswar

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STRENGTH OF MATERIALS - II

	L	T	P
CODE MA 41			
CE 41/ME 41	2	2/2	2

RATIONALE

In Engineering every structure or machine element is designed for a particular application. Then it is tested. A Diploma holder should be capable of designing the various elements for particular requirements. For this he must be able to calculate the stresses in an elements and their nature.

CONTENTS

1. Deflection :

1.1 Concept of deflection of a beam
1.2 Use of standard formula for calculating deflection (for point loads, U.D.L. and their combination)

- 1.2.1 Cantilever beam
- 1.2.2 Simply supported beam

2. Columns and Struts :

2.1 Concept of column and struts
2.2 Modes of failure
2.3 Types of column; long and short
2.4 Buckling loads
2.5 Slenderness ratio
2.6 Euler's formula (without proof)

- 2.6.1 Both ends hinged
- 2.6.2 One end fixed and other end free
- 2.6.3 Both ends fixed
- 2.6.4 One end fixed and other end hinged
- 2.6.5 Limitations of Euler's Formula
- 2.6.6 Equivalent length

2.7 Rankine's formula

3. Torsion of Shaft :

3.1 Concept of torsion

- 3.1.1 Angle of twist
- 3.1.2 Polar moment of Inertia
- 3.1.3 Assumptions in the theory of pure torsion

3.2 Derivation and use of

$$\frac{q}{r} = \frac{T}{J} = \frac{N\theta}{l}$$

3.3 Relation between power and torque
3.4 Combined stress due to bending and torsion in solid and hollow shaft

4. Springs :

4.1 Introduction and classification of springs
4.2 Flat carriage springs

- 4.2.1 Application of flat carriage springs
- 4.2.2 Determination of number of leaves and their sections, deflection and radius of curvature
- 4.2.3 Quarter elliptical spring

4.3 Closely coiled helical springs :

4.3.1 Application of closely coiled helical springs
4.3.2 Determination of deflection, angle of twist, number of coils and stiffness under axial loading in closely coiled helical springs.

5. Thin Cylindrical Shells :

5.1 Use of cylinders
5.2 Stresses due to internal pressure

5.2.1 Circumferential stress or hoop stress
5.2.2 Longitudinal stress

5.3 Design of thin cylinders - calculation of the various dimensions of a thin cylinder

6. Combined Direct and Bending Stress :

6.1 Effect of eccentricity
6.2 Stress due to eccentric load
6.3 Middle third rule

7. Frames :

7.1 Different types of frames
7.2 Calculation of forces in the members of determinate frames

7.2.1 Method of Joints
7.2.2 Method of section
7.2.3 Graphical method

PRACTICALS

1. Determination of deflection for various types of loading
2. Torsion test on brass and mild steel
3. Compression test on columns
4. Determination of stiffness of close coiled spring
5. Deflection test on leaf spring.

REFERENCE BOOKS :

1.	Strength of Materials & Theory of Structures (Vol. I)	B.C.Punmia
2.	Strength of Materials	Ramamurtham
3.	Strength of Materials	Junarkar
4.	Strength of Materials	R.S. Khurmi
5.	Strength of Materials (Hindi)	Gurcharan Singh

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FLUID MACHINES

	L	T	P
CODE MA 42 / ME 42	2	2/2	2

RATIONALE

A Diploma holder has to supervise the various machines working on the principles of hydraulics. Major among those machines are hydraulic turbines, pumps, hydraulic crane, presses etc. The aim of this subject is to impart the knowledge of working principles, construction and working of various machines.

CONTENTS

1. Flow Through Pipes :

1.1 Types of flow in pipes (Reynold's experiment)

- 1.1.1 Laminar flow
- 1.1.2 Turbulent flow
- 1.1.3 Transient flow

1.2 Law of fluid friction

- 1.2.1 Laminar flow
- 1.2.2 Turbulent flow

1.3 Loss of head due to friction (No. proof)

- 1.3.1 Darcy's Weisbach equations
- 1.3.2 Chezy's formula
- 1.3.3 Manning formula

1.4 Other energy losses in pipe (only expressions)
1.5 Total energy line and hydraulic gradient line
1.6 Pipe arrangement

- 1.6.1 Pipes in series
- 1.6.2 Pipes in parallel

1.7 Transmission of power through pipes
1.8 Siphon
1.9 Water hammer

2. Impact of Free Jet :

2.1 Impulse momentum equation (no proof)
2.2 Force exerted by a fluid jet on stationery flat plate

- 2.2.1 Plate normal to the jet
- 2.2.2 Plate inclined to the jet

2.3 Force exerted by fluid jet on moving flat plate

- 2.3.1 Plate normal to the jet
- 2.3.2 Plate inclined to the jet

2.4 Force exerted by fluid jet on stationary curved vane

- 2.4.1 Jet strikes at the centre of symmetrical cured vane
- 2.4.2 Jet strikes tangentially at one

2.5 Force exerted by a fluid jet on moving curved vane.

3. Hydraulic Turbines :

3.1 Classification of water turbines
3.2 Pelton turbine

3.2.1 Working principle
3.2.2 Constructional features

3.3 Francis turbine and Kaplan turbine

3.3.1 Working principle
3.3.2 Constructional features

3.4 Draft tube
3.5 Cavitation
3.6 Governing of Turbines

3.6.1 Need for governing
3.6.2 Simple governing mechanism

3.7 Surge tank
3.8 Turbine performance

3.8.1 Heads - gross, net
3.8.2 Efficiency - Hydraulic, Mechanical, Volumetric, Overall
3.8.3 Unit quantities
3.8.4 Specific speed
3.8.5 Introduction to characteristics curve (no numerical problems)

3.9 Numerical problems on turbines

4. Centrifugal Pump :

4.1 Introduction and working principles
4.2 Advantages over reciprocating pump
4.3 Classification
4.4 Constructional features

4.4.1 Mechanical manometric and overall efficiency

4.5 Head of a pump - static, manometric

4.5.1 Power required to drive the pump

4.6 Losses in pump and efficiency
4.7 Minimum stating speed
4.8 Pumps in series and parallel
4.9 Priming
4.10 Description and working of multistage centrifugal pump, submersible, deepwell pump and gear pump.
4.11 Numerical problems

5. Reciprocating Pump :

5.1 Types of pump
5.2 Main components and working
5.3 Slip

5.3.1 Percentage slip
5.3.2 Negative slip

5.4 Work down by a reciprocating pump

5.5 Acceleration of piston

5.5.1 Its effect on velocity and pressure

5.6 Air vessel
5.7 Troubles in Reciprocating pump and their remedies.
5.8 Numerical problems

6. Miscellaneous Hydraulic Machines :

6.1 Description, working principle of following machines
- 6.1.1 Hydraulic accumulator
- 6.1.2 Hydraulic intensifier
- 6.1.3 Hydraulic press
- 6.1.4 Hydraulic coupling and torque converter

PRACTICALS

1. Determination of coefficient of friction for pipes
2. Determination of slip, coefficient of Discharge for a reciprocating pump
3. To draw characteristics curves and efficiency curves of
   - 3.1 Centrifugal pump
   - 3.2 Pelton wheel turbine
   - 3.3 Francis turbine
4. Study of model of Kaplan turbine
5. Study of submersible pump, jet pump, deepwell pump.

REFERENCE BOOKS :

1.	Fluid Mech. & Machines	Dr. Jagdish Lal
2.	Fluid Mech. & Machines	Dr. R.K.Bansal
3.	Fluid Mechanics & machines	R.S.Khurmi.
4.	Hydraulics & Pneumatics	H.L. Stewart
5.	Fluid Machines	S.S. Ratan

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AUTO ENGINE - COMPONENTS AND PERFORMANCE

CODE MA 43

L	T	P
2	2	--

RATIONALE

This subject imparts the basic knowledge of auto engine air compress and Gas Turbine. Constructional details, materials and detail study of piston, connecting rod, crank shaft, cylinder block, engine valves and bearing etc.

CONTENTS

1. Classification of Auto Engines :

1.1 Classification of Auto Engines :

- 1.1.1 Cycle
- 1.1.2 Strokes
- 1.1.3 Fuels
- 1.1.4 Ignition
- 1.1.5 Cooling
- 1.1.6 Speed
- 1.1.7 Number and arrangement of cylinders
- 1.1.8 Governing
- 1.1.9 Types of placement of valves etc.

2. Engine Components : Constructional details, specifications, qualities, functions, types, materials, working, defects and its rectifications of these parts.

2.1 Cylinder :

- 2.1.1 Cylinder and cylinder block
- 2.1.2 Dry and wet cylinder liners
- 2.1.3 Cylinder head, crank cases and oils pan or sump

2.2 Piston :

- 2.2.1 Cast iron piston,
- 2.2.2 Steel piston
- 2.2.3 Aluminium alloy piston
- 2.2.4 Slipper piston
- 2.2.5 Oval section piston
- 2.2.6 T-slot piston
- 2.2.7 Invar strut piston
- 2.2.8 Coating for aluminium piston
- 2.2.9 Piston slap
- 2.2.10 Major and minor thrust surfaces.

2.3 Piston Rings :

- 2.3.1 Compound rings
- 2.3.2 Oil scrapper ring
- 2.3.3 Compression ring
- 2.3.4 Chromium plated ring
- 2.3.5 Ring gap and Ring clearance

2.4 Piston Pin :

- 2.4.1 Floating piston pin
- 2.4.2 Fix pin
- 2.4.3 Offset piston pin

2.5 Connecting Rod :

- 2.5.1 Components of connecting rod
- 2.5.2 Cooling of big end small end of connecting rod
- 2.5.3 Lubrication of connecting rod bearing

2.6 Crank Shaft :

- 2.6.1 Single cylinder crank shaft
- 2.6.2 Multi cylinder crank shaft
- 2.6.3 Left hand crank shaft
- 2.6.4 Right hand crank shaft
- 2.6.5 Hardening of crank shafts
- 2.6.6 Balancing of crank shaft
- 2.6.7 Vibration damper

2.7 Flywheel :

- 2.7.1 Components
- 2.7.2 Ring gear

2.8 Cam Shaft :

- 2.8.1 Components of cam
- 2.8.2 Cam driving mechanism
  - 2.8.2.1 Chain drive
  - 2.8.2.2 Timing gear drive
  - 2.8.2.3 Timing belt drive
- 2.8.3 Overhead cam shaft
- 2.8.4 Valve timing adjustment and fixing

2.9 Engine Valve :

- 2.9.1 Components and Dimensions
- 2.9.2 Poppet valves
- 2.9.3 Sodium cooled valves
- 2.9.4 Metal coated valves
- 2.9.5 Valve seating
- 2.9.6 Valve pocketing
- 2.9.7 Valve spring
- 2.9.8 Valve operating mechanisms
- 2.9.9 Valve tappet clearance and adjustment

2.10 Gasket :

- 2.10.1 Cylinder head gasket
- 2.10.2 Oil pan gasket
- 2.10.3 Manifold gasket
- 2.10.4 Pump gasket

2.11 Bearing :

- 2.11.1 Requirements of bearing
- 2.11.2 Main bearing
- 2.11.3 Big and bearing
- 2.11.4 Bearing failures and its causes

3. I.C. Engine Fundamentals :

- 3.1 Bore
- 3.2 Stroke
- 3.3 Clearance volume
- 3.4 Swept volume
- 3.5 Compression ratio
- 3.6 Crank throw
- 3.7 Dead centres
- 3.8 Piston displacement

3.9 Piston speed,
3.10 Concept of energy work heat and power
3.11 Working principal of 4 stroke and 2-stroke cycle and their comparison
3.12 Valve timing diagrams and firing order (power balancing)
3.13 Simple Numerical problems

4. Testing and Performance of I.C. Engines :

4.1 Basic Performance parameters,
4.2 Measurements of -

4.2.1 Speed
4.2.2 Air consumption
4.2.3 Fuel consumption
4.2.4 friction power, brake power, indicated power
4.2.5 Heat going to cooling water exhaust etc.

4.3 Exhaust gas analysis

4.3.1 Smoke density measurement
4.3.2 Emission measurement (Indian emission norms)
4.2.3 Euro I and Euro II

4.4 Performance Maps
4.5 Selection of engine - On basic of fuel used, two-stroke or four-stroke, air-cooled or water-cooled, super charging, number and arrangement of cylinders etc.
4.6 Simple numerical problems

5. Gas Turbine :

5.1 Classification and application of gas turbines
5.2 Description of constant pressure (open cycle and closed cycle) and constant volume gas turbines.
5.3 Comparison of gas turbine and reciprocating I.C. engine
5.4 Methods of increasing thermal efficiency of gas turbines, regeneration, inter cooling, re-heating.
5.5 Simple numerical problems

6. Air Compressors :

6.1 Classification of compressors, uses of compressed air
6.2 Description of single stage and multi stage reciprocating compressors
6.3 P.V. diagram of single and multi stage reciprocating compressor with inter cooling
6.4 Power required (without clearance volume) for single stage and multi stage compressors
6.5 Description of rotary and centrifugal compressors
6.6 Numerical problems on reciprocating compressors.

REFERENCE BOOKS :

1.	High-Speed Combustion Engine	P.M.Heldt
2.	Automobile Engine	Arthur W. Judge
3.	Automobile Engg.	Kirpal singh
4.	Automobile Engg .	R.B. Gupta
5.	Automobile Engg.	C.P.Nakra
6.	Vehicle &Engine Technology (Vol. I & II)	Heinz Heisler
7.	Auto Design	R.B. Gupta
8.	Auto Engine Design	Crouse, Anglin
9.	Automotive Mechanics	Joseph Heitner

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AUTO ENGINE

CODE MA 44

L	T	P
3	--	2

RATIONALE

The subject of auto engine is included in the curriculum to impart the knowledge of combustion, combustion chambers of various types and to understand the complete phenomenon of combustion air fuel system. Effect of environment on the performance of engines. This knowledge helps in understanding the subject of autoshop and garage practice and awareness with the latest trend in modern engines.

CONTENTS

1. Gas Power Cycles :

1.1 Otto cycle, Diesel cycle, Dual combustion cycle, Atkinson brayton cycle
1.2 Air standard efficiency
1.3 Comparison between theoretical and actual cycles
1.4 Effect of compression ratio on efficiency
1.5 Numerical Problems

2. Combustion in S.I. Engine :

2.1 General idea of combustion theory
2.2 Ignition limits of air / fuel mixture
2.3 Normal combustion stages
2.4 Effect of engine variables on ignition lag and flame propagation.
2.5 Rate of pressure size
2.6 Abnormal combustion
2.7 Detonation and effects of detonation
2.8 Theories of detonation
2.9 Effect of engine variables on detonation
2.10 Control of detonation
2.11 Abnormal combustion knock
2.12 Surface ignition

3. S.I. Engine Combustion Chambers :

3.1 Basic requirements of a good combustion chamber
3.2 Combustion chamber design principles
3.3 Comparison of various types of combustion chambers with line sketches by only the position of valves and spark plugs.
3.4 Description of the combustion chamber namely

3.4.1 Bathtub shape
3.4.2 Wedge shape
3.4.3 Ricardo turbulent head
3.4.4 Hemispherical shape
3.4.5 Recessed or cavity shapes

4. Combustion In C.I. Engines :

4.1 Stages of combustion
4.2 Air fuel ratio
4.3 Delay period or ignition lag
4.4 Variables effecting delay period
4.5 Diesel knock
4.6 Methods of controlling diesel knock

5. C.I. Engine Combustion Chambers :

5.1 C.I. engine combustion chambers
5.2 Methods of generating air swirl

5.3 Induction swirl and open combustion chambers
5.4 Compression swirl and divided or turbulent swirl chambers
5.5 Combustion induced swirl and divided chambers

6. I.C. Engine Fuels :

6.1 Petroleum and non petroleum base liquid fuels
6.2 Chemical structure of liquid petroleum fuel
6.3 Gaseous fuels
6.4 Heating value of fuels (concept only)
6.5 Rating of S.I. fuels

6.5.1 Knock rating - octane no.
6.5.2 Highest useful compression ratio (H.U.C.R.)
6.5.3 sensitivity
6.5.4 Performance number

6.6 Effect of chemical structure of fuel on knocking
6.7 Chemical control of knocking - Gasoline additives
6.8 Rating of C.I. fuel - cetane no
6.9 Effects of fuel structure on C.I. engine ignition quality additives for C.I. engine fuels
6.10 Important characteristic required for S.I., C.I. and gas turbine fuels gas turbine fuels.
6.11 Introduction to gaseous fuel such as natural gas, producer gas.
6.12 Introduction to alternative fuels for I.C. engines, elementary idea of petroleum refining.

7. Air Fuel System for S.I. Engine :

7.1 Types of fuel feed system :

7.1.1 Gravity feed
7.1.2 Pump feed

7.2 Fuel filters
7.3 Air cleaner - dry type, wet type
7.4 Carburation

7.4.1 Purpose of carburation
7.4.2 Theory of simple carburetor
7.4.3 Carburetor classification
7.4.4 Concept of constant choke and constant vacuum class of carburetors
7.4.5 Engine air /fuel mixture requirements
7.4.6 Transient and steady state requirements
7.4.7 Typical performance curves of carburetor

7.4.7.1 Air flow v/s air / fuel ratio
7.4.7.2 Throttle opening v/s air / fuel ratio

7.5 Carburetor Systems :

7.5.1 Float
7.5.2 idling
7.5.3 low speed
7.5.4 high speed (main metering)
7.5.5 Power enrichment
7.5.6 acceleration
7.5.7 Choke system

7.6 Fuel injection system for gasoline engine :

7.6.1 Advantages and disadvantages of fuel injection
7.6.2 Type of fuel injection

7.6.2.1 Direct injection
7.6.2.2 Port injection
7.6.2.3 Manifold injection

7.7 Method of injection

7.7.1 Timed
7.7.2 Continuous type

7.8 Introduction to mechanical fuel injection
7.9 Electronic fuel injection

7.9.1 Multi point fuel injection (MPFI)
7.9.2 Single point fuel injection

7.10 Electronics control unit (E.C.U.)
7.11 Electronic fuel injection control sensors
7.12 Injection timing and duration
7.13 L.P.G. fuel system
7.14 C.N.G. System

8. Air - Fuel System for C.I. Engines :

8.1 Requirement of injection
8.2 Solid injection system
8.3 Air injection system
8.4 Component of diesel fuel system
8.5 Rotary fuel injection pump
8.6 Cold starting add for C.I. Engines
8.7 Quantity of fuel / cycle
8.8 Size of nozzle required
8.9 Spray formation
8.10 Spray direction
8.11 Injection timing

9. Super Charging :

9.1 Object
9.2 Super charging of C.I. and S.I. engine
9.3 Effect of super charging on performance engine
9.4 Method of super charging
9.5 Super chargers
9.6 Introduction to turbo charging

10. Cooling , Lubrication And Exhaust System :

10.1 Type of cooling system
10.2 Coolants
10.3 Basic requirements of lubricants
10.4 Properties of the lubricating oil
10.5 Service rating of oil
10.6 Classification of lubricating oil
10.7 Exhaust system
10.8 Exhaust manifold muffler
10.9 Catalytic converter

11. Miscellaneous :

11.1 Working principle of

11.1.1 Striling engine
11.1.2 Wankel rotary engine
11.1.3 Turbojet
11.1.4 Ram jet engine
11.1.5 Free piston engine

PRACTICALS

1. Dismantling and assembling of petrol engine.
2. Dismantling and assembling of diesel engine.

3. Checking and preparing measurement sheet for petrol / diesel engine
4. Fault finding in following system

    4.1 Cooling system
    4.2 Lubrication system
    4.3 Fuel system
    4.4 Ignition system
    4.5 Exhaust system

5. Tune-up of engine by tunning equipment
6. Finding out the I.P, B.P and mechanical efficiency by Morse test.
7. Preparing heat balance sheet.
8. Emission measurement by smoke meter and exhaust gas anaylser.

REFERENCE BOOKS :

1.	Internal Combustion Engines	M.L.Mathur & R.P.Sharma
2.	Automobile Engines	Dr. Kirpal singh
3.	Automobile Engine	Arthur W.Judge.
4.	Automobile Engg.	R.B. Gupta
5.	Automobile Engg.	H. Croure
6.	I.C. Engines	Lester C. Lichty.

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WORKSHOP TECHNOLOGY - I

	L	T	P
CODE MA 45			
ME 45	2	--	6

RATIONALE

This subject would impart the knowledge of various production machinery. The knowledge of metal cutting would help the student in acquiring requisite skills to open up his own workshop or in an industry.

CONTENTS

1. Cutting Tools and Materials :

1.1 Cutting tools

1.1.1 Standard shape of single point tool
1.1.2 Cutting angles, effect of rake angle, importance of clearance angle
1.1.3 Heat produced by cutting and its effect
1.1.4 Cutting speed, feed and depth of cut

1.2 Materials

1.2.1 Materials of cutting tools and their properties
1.2.2 High-speed steel, cobalt steel, tungsten carbide, cemented carbide, stellite, diamond, ceramics.

2. Lathe Machine :

2.1 Specifications, Classification of lathe machines
2.2 Constructional features of a centre lathe and its function
2.3 Functions of various parts of lathe
2.4 Different operations, which can be performed on the centre, lathe with and without attachments.
2.5 Calculation of gear trains for thread cuttings
2.6 Lathe attachments and lathe accessories.

3. Drilling Machines :

3.1 Description, working and uses of different drilling machines, Multi spindle drill, gang drill, deep hole drill and small diameter hole drill machines.
3.2 Specifications and constructional features of radial arm and upright drilling machines
3.3 Work holding devices, tool holding devices
3.4 Description and types of drills and reamers
3.5 Various operations of drilling machines e.g. drilling, reaming, boring, counter-boring, counter sinking, spot facing, tapping.
3.6 Selection of drill
3.7 Cutting speed and feed according to material of job.

4. Shaping, Planning and Slotting Machines :

4.1 Description, working and uses of various types of shapers, planers and slotters
4.2 Specification, constructional features of a shaper and planner in detail
4.3 Mechanism used in shaper - crank and slotted link, whitworth quick return and hydraulic mechanism, Feed mechanism
4.4 Mechanism of planner
4.5 Various works holding devices and clamping devices used on shaper and planner
4.6 Various shaper and planner operations
4.7 Shaper and planner tools
4.8 Cutting speed, feed and depth of cut on shaper and planner
4.9 Difference between shaper, planner and slotter

5. Cutting Fluids and Cooling Process :

5.1 Difference between cutting fluid and coolant
5.2 Functions of cutting fluid and its action

5.3 Requirements of good cutting fluid
5.4 Types of cutting fluids
5.5 Selection of cutting fluids for different material and operations.

PRACTICALS

1. Grinding of various types of single point cutting tool
2. Simple exercise on Lathe Machine involving following operation

   2.1 Simple turning, facing, step turning, Grooving and knurling and taper turning, by compound rest
   2.2 Facing, drilling, boring and step turning, parting off.
   2.3 Taper turning by tails tock off set method
   2.4 V threading, square threading and taper threading by attachment
   2.5 A utility job on lathe machine with an accuracy of ± 0.2 mm

3. Preparing a M.S. block with all faces finished and V grooved on shaper machine
4. Planning practice on a planner on a rectangular C.I plate.
5. Internal slot cutting on the slotter machine

REFERENCE BOOKS :

1. Workshop Technology (Hindi) - II — Tahil Manghnani
2. Workshop Technology (Hindi) - II — B.S.Raghuvanshi
3. Workshop Technology - II — Hazra & Chaudhary.
4. Workshop Technology (Hindi) — S.K.Bhatnagar
5. Production Technology — R.K. Jain
6. All about M/C tools — Gerling

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METROLOGY

	L	T	P
CODE MA 46			
ME 46	2	--	2

RATIONALE

Technicians have to carry out the job of measurement and inspection in the factories for controlling the quality of products. Therefore they must have the knowledge of science of measurements or metrology. They must be familiar with the concept and technique of inspection and quality control methods.

This subject i.e. Metrology has been designed to impart all the related and concerned knowledge to the student to fulfill the need.

The content of syllabus broadly includes linear and angular measurement of surfaces, measurements by comparators, light wave interferometry, gear, screw measurements and inspection.

Finally, to develop the skill in measurement a list of practicals is also given which should be carried out by the students in metrology laboratories.

CONTENTS

1. Introduction :

1.1 Units and standards of measurement
1.2 International, National and company standards
1.3 Line and end standards
1.4 Errors in measurement
1.5 Precision and accuracy

2. Linear and Angular Measurement :

2.1 Vernier calliper, micrometers, height and depth gauges
2.2 Bevel protractor, sine bar, slip gauges, angle gauges and clinometers
2.3 Auto collimator, angle dekkar,
2.4 Taper measurements
2.5 Cylinder bore gauge, Telescopic gauge, feeler and wire gauge

3. Measurement of Surface Finish :

3.1 Meaning of surface texture, primary and secondary texture
3.2 Terminology of surface roughness
3.3 Factors affecting surface finish
3.4 Representation of surface roughness parameters CLA and RMS values
3.5 Comparison and direct instrument methods of surface finish measurements.

4. Comparators :

4.1 Classification, advantages and working mechanism of dial indicators, passmeters
4.2 Mechanical, Electrical, Electronic and pneumatic comparators

5. Light Wave Interference :

5.1 Principle of interference
5.2 Interferometry applied to flatness testing
5.3 N.P.L. flatness interferometer

6. Gear and Screw Measurement :

6.1 Screw thread terminology, errors in threads
6.2 Effective diameter measurement by two wire and three wire methods
6.3 Major and minor diameter measurement, Thread micrometers
6.4 Gear tooth terminology

6.5 Gear tooth vernier calliper and its application
6.6 Measurement of gear pitch.

7. Limits, Fits and Tolerance :

7.1 Interchangeability - control and need
7.2 Definitions and Terminology of limits, fits and tolerances
7.3 Basis of limit system
7.4 Type of fits
7.5 Limit gauges

8. Machine Tool Metrology :

8.1 Alignment tests
8.2 Performance tests
8.3 Alignment test on lathe and drilling machine

9. Inspection :

9.1 Inspection - concept, need and methods
9.2 Types of inspection.

PRACTICALS

1. Internal and External measurement with the vernier calliper
2. Internal and External measurement with micrometer
3. Measurement with height and depth gauges.
4. Measurement with dial indicator using surface plate and accessories for -
   4.1 Flatness
   4.2 Concentricity
5. Measurement with combination set and bevels protractor
6. Measurement of thread characteristics
7. Study and use of slip gauges
8. Study of limit gauges.
9. Internal and External taper measurement.
10. Measurement of gear characteristics
11. Measurement of angle with sine bar and slip gauges
12. Study and use of comparators
13. Study and use of tool room microscopes.
14. Measurement of bore with cylinder dial gauge for ovality and taper.
15. Measurement of worn out I.C. Engine piston, clearance between cylinder and piston and between bearing and journal

Note : Industrial visit can be arranged to show these practicals to the students.

REFERENCE BOOKS :

1. Engineering Metrology — R.K.Jain
2. Engineering Precision Metrology — R.C.Gupta
3. Engineering Metrology (Hindi) — Mittal
4. Engineering Metrology (Hindi) — Bhatnagar.
5. Engineering Metrology — R.K.Rajput
6. Metrology Lab Manual — Adithen, Bahl
7. Metrology — M. Mahajan

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THEORY OF MACHINES

	L	T	P
CODE MA 47			
ME 47	3	2	--

RATIONALE

An engineer should be well acquainted with the motion of mechanism of different machine element. With this view the study of Theory of machine is very much important.

The contents of this subject include simple mechanism, kinematics of machine, dynamics of reciprocating parts, friction involved in the machine elements, power transmission, governors, balancing and vibrations in machine.

CONTENTS

1. Simple Mechanism :

1.1 Introduction to link, kinematic pair, kinematic chain, structure, mechanism, machine
1.2 Slider crank mechanism and its inversion
1.3 Double slider crank chain
1.4 Example of mechanism with higher pairs

2. Velocity and Acceleration in Mechanism :

2.1 Velocity diagrams of four bar and single slider crank mechanisms by relative velocity method and instantaneous centre method
2.2 Acceleration diagram of four bar chain and reciprocating engine mechanism

3. Dynamics of Reciprocating Parts :

3.1 Analytical method for velocity and acceleration of piston
3.2 Piston effort, crank pin effort, turning moment diagrams
3.3 Fluctuation of energy and speed
3.4 Energy of a flywheel
3.5 Calculating the weight of flywheel.

4. Friction :

4.1 Friction of collars and pivots
4.2 Friction clutches-plate clutch and centrifugal clutch
4.3 Friction in journal bearings
4.4 Rolling friction
4.5 Prony brake, Rope brake and Froude's hydraulic dynamometer.

5. Transmission of Power :

5.1 Flat and V-belt drives
5.2 Velocity ratio of belt drives, slip in belt, and creep in belt.
5.3 Length of open and cross belt drives
5.4 Power transmitted by a belt
5.5 Ratio of driving tension, centrifugal tension, Condition for the maximum power transmission, initial tension in the belt.
5.6 Chain drives - types of chain drives roller chain and inverted tooth chain.
5.7 Gear drives - Types of gear wheels, proportions of gear tooth
5.8 Gear trains - Simple gear train, compound gear train, reverted gear train and simple epicyclical gear train.

6. Balancing :

6.1 Static and dynamic balancing
6.2 Balancing of single rotating mass by a single mass in the same plane, by two masses rotating in different planes.
6.3 Partial primary balancing of a single cylinder reciprocating engine

7. Vibration :

7.1 Causes of vibrations in machine, their effects and method of reducing them
7.2 Free or natural vibration
7.3 Forced vibration
7.4 Damped vibration.

REFERENCE BOOKS :

1. मशीन का सिद्धांत — कपूर एवं कुमार
2. Theory of Machines — Jagdishlal
3. Theory of Machines — R.S.Khurmi
4. Theory of Machines — Abdullah Sharif
5. Theory of Machines — Malhotra, Gupta
6. Theory of Machines — S.S. Ratan

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