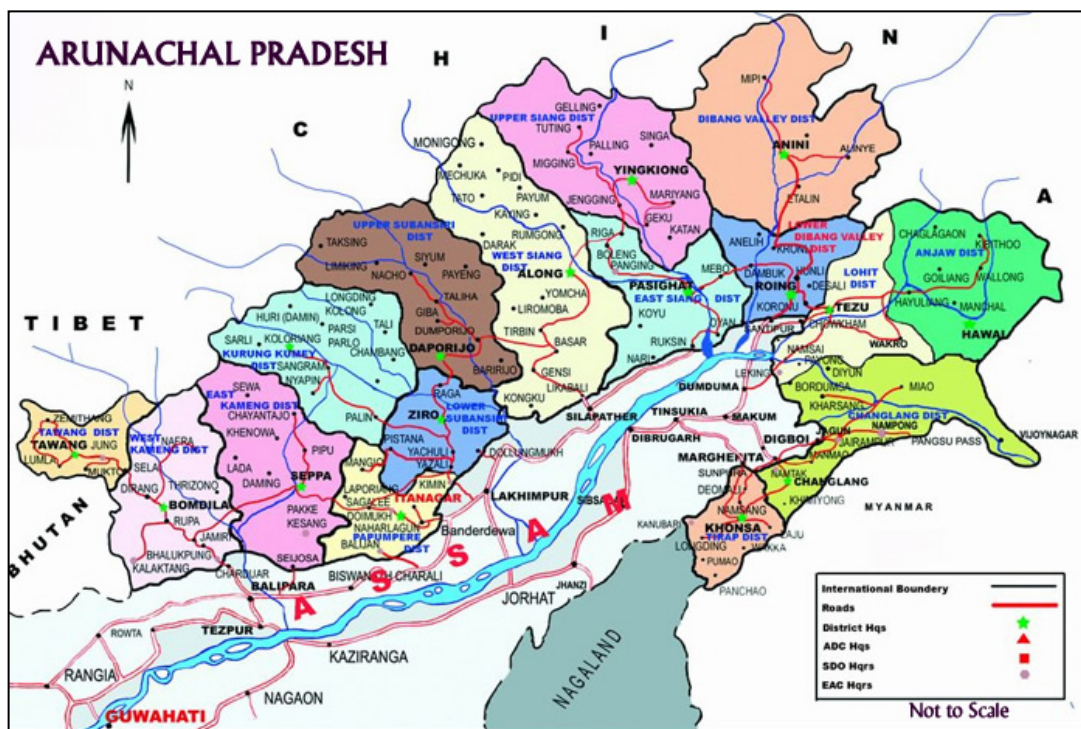


February 2013

REVISED CURRICULUM OF AUTOMOBILE ENGINEERING DIPLOMA PROGRAMME IN MULTI POINT ENTRY & CREDIT SYSTEM



For the State of Arunachal Pradesh

PART –II



National Institute of Technical Teachers' Training & Research
Block – FC, Sector – III, Salt Lake City, Kolkata – 700 106

<http://www.nitttrkol.ac.in>

REVISED CURRICULUM OF PART - II

AUTOMOBILE ENGINEERING DIPLOMA PROGRAMME

IN MULTI POINT ENTRY & CREDIT SYSTEM



**NATIONAL INSTITUTE OF TECHNICAL TEACHERS'
TRAINING AND RESEARCH**
Block - FC, Sector - III, Salt Lake City, Kolkata - 700106

February 2013

Foreword

Government of Arunachal Pradesh has entrusted NITTTR, Kolkata for revising the existing course curricula in eight subject areas and for developing the new course curricula in the two areas.

Revised Course Curricula:

1. Herbal Technology
2. Garment and Fashion Technology
3. Hotel Management and Catering Technology
4. Travel and Tourism Management
5. Electrical and Electronics Engineering
6. Civil Engineering
7. Computer Science and Engineering
8. Automobile Engineering

New Course Curricula:

1. Electronics and Communication Engineering
2. Electrical Engineering
3. Mechanical Engineering

The Institute conducted a series of workshop involving experts in different subject areas for development of the course curricula. An effort has also been made to ensure that the revised course curricula do not deviate significantly from the existing course curricula and at the same time reflect the recent trends in a particular subject area.

The Institute welcomes any meaningful suggestions which can be incorporated in the final versions of the above said document.

Sd/-
(Prof. S. K. Bhattacharyya)
Director
NITTTR, Kolkata

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Scheme of Studies and Evaluation (MPECS) Automobile Engineering

1. FOUNDATION COURSES:

Sl. No	Code	Course	Study Scheme				Evaluation Scheme						Total Marks	Credit
			Pre-requisite	Contact Hour/Week			Theory			Practical				
				L	T	P	End Exam	Progressive Assessment		End Exam	Progressive Assessment			
								Class Test	Assignment		Sessio nal	Viva		
1	G101	Communication Skill -I		3	0	0	75	10	15	0	0	0	100	3
2	G102	Communication Skill -II	G101	2	1	2	50	0	0	25	25	0	100	4
3	G103	Mathematics I		3	1	0	75	10	15	0	0	0	100	4
4	G104	Mathematics II		3	1	0	75	10	15	0	0	0	100	4
5	G105	Physics I		3	0	2	75	10	15	25	25	0	150	4
6	G106	Physics II	G105	3	0	2	75	10	15	25	25	0	150	4
7	G107	Chemistry I		3	0	2	75	10	15	25	25	0	150	4
8	G108	Chemistry II	G107	3	0	2	75	10	15	25	25	0	150	4
9	G109	NSS1/NCC1		0	0	2	0	0	0	25	25	0	50	1
10	G110	NSS2/NCC2		0	0	2	0	0	0	25	25	0	50	1
TOTAL				23	3	14	575	70	105	175	175	0	1100	33

2. HARD CORE COURSES: Automobile Engineering

Sl. No	Code	Course	Study Scheme				Evaluation Scheme						Total Marks	Credit
			Pre-requisite	Contact Hour/Week			Theory			Practical				
				L	T	P	End Exam	Progressive Assessment		End Exam	Progressive Assessment			
								Class Test	Assignment		Sessio nal	Viva		
11	G201	Engineering Drawing I		1	0	3	50	0	0	0	50	0	100	3
12	G202	Engineering Drawing II	G201	1	0	3	50	0	0	0	50	0	100	3
13	G203	Workshop Practice I		1	0	3	0	0	0	50	50	0	100	3
14	G204	Workshop Practice II	G203	1	0	3	0	0	0	50	50	0	100	3
15	G205	Engineering Mechanics		3	0	0	75	10	15	0	0	0	100	3
16	G206A	Introduction to Computer Programming		2	1	2	50	0	0	25	25	0	100	4
17	G207	Fundamentals of Electrical & Electronics Engineering		3	0	2	75	10	15	25	25	0	150	4
TOTAL				12	1	16	300	20	30	150	250	0	750	23

3. SOFT CORE COURSES: (G301 and Any One of G302) Automobile Engineering

Sl. No	Code	Course	Study Scheme				Evaluation Scheme						Total Marks	Credit
			Pre-requisite	Contact Hour/Week			Theory			Practical				
				L	T	P	End Exam	Progressive Assessment		End Exam	Progressive Assessment			
								Class Test	Assignment		Sessio nal	Viva		
18	G301	Environmental Education		3	0	0	75	10	15	0	0	0	100	3
19	G302A	Engineering Economics & Accountancy		3	0	0	75	10	15	0	0	0	100	3
20	G302B	Principles of Management		3	0	0	75	10	15	0	0	0	100	3
21	G302C	Entrepreneurship Development		3	0	0	75	10	15	0	0	0	100	3
22	G302D	Organizational Behaviour		3	0	0	75	10	15	0	0	0	100	3
23	G302E	Elements of Electronics		3	0	0	75	10	15	0	0	0	100	3
24	G302F	Materials Science	G105, G106, G107, G108	3	0	0	75	10	15	0	0	0	100	3
TOTAL				6	0	0	150	20	30	0	0	0	300	6

4. BASIC TECHNOLOGY COURSE: Automobile Engineering

Sl. No	Code	Course	Study Scheme				Evaluation Scheme						Total Marks	Credit
			Pre-requisite	Contact Hour/Week			Theory			Practical				
				L	T	P	End Exam	Progressive Assessment		End Exam	Progressive Assessment			
				Class Test	Assignment			Sessio nal	Viva					
25	AE401	Automobile Drawing		1	0	3	50	0	0	0	50	0	100	3
26	AE402	Manufacturing Processes		3	0	0	75	10	15	0	0	0	100	3
27	AE403	Strength of Materials and Machine Design		3	0	0	75	10	15	0	0	0	100	3
28	AE404	Theory of Machines		3	0	0	75	10	15	0	0	0	100	3
29	AE405	Heat Power Engineering		3	0	0	75	10	15	0	0	0	100	3
30	AE406	Fluid Mechanics and Machines		3	0	3	75	10	15	25	25	0	150	5
31	AE407	Metrology and Quality Control		3	0	3	75	10	15	25	25	0	150	5
32	AE408	Automobile Engine -I		3	0	3	75	10	15	25	25	0	150	5
33	AE409	Automobile Engine -II		3	0	3	75	10	15	25	25	0	150	5
34	AE410	Workshop Practice -III		0	1	4	0	0	0	50	50	0	100	3
35	AE411	Automobile Chassis		3	0	3	75	10	15	25	0	25	150	5
TOTAL				28	1	22	725	90	135	175	200	25	1350	43

5. APPLIED TECHNOLOGY COURSE: : Automobile Engineering

Sl. No	Code	Course	Study Scheme				Evaluation Scheme						Total Marks	Credit
			Pre-requisite	Contact Hour/Week			Theory			Practical				
				L	T	P	End Exam	Progressive Assessment		End Exam	Progressive Assessment			
				Class Test	Assignment			Sessio nal	Viva					
36	AE501	Automotive Air Conditioning		2	1	4	50	10	15	25	25	0	100	5
37	AE502	Vehicle Maintenance and Garage Practice		2	1	4	50	0	0	25	25	0	100	5
38	AE 503	Transport Management and Motor Vehicle Act		3	0	0	75	10	15	0	0	0	100	3
39	AE504	Automobile Workshop		0	1	4	0	0	0	50	50	0	100	3
40	AE505	Automobile Power Train		3	1	2	75	10	15	25	25	0	150	5
41	AE506	Automobile Electronics		3	1	2	75	10	15	25	25	0	150	5
42	AE507	Auto Engine Reconditioning		2	1	4	50	0	0	25	25	0	100	5
43	AE508	Auto Body Work Practices		3	1	2	75	10	15	25	25	0	150	5
44	AE 509	Project		0	0	8	0	0	0	0	100	50	150	4
45	AE510	Driving Practice		0	1	2	0	0	0	0	25	25	50	2
46	AE511	Technical Seminar		0	0	6	0	0	0	0	50	50	100	3
47	AE512	Industrial Training (3 weeks OJT + 1 week orientation)*		0	0	0	0	0	0	0	100	100	200	10
TOTAL				18	8	35	475	50	75	200	475	225	1450	55

*Students must be either in 4th Term or higher.

6. ELECTIVE COURSE: (any TWO to be taken) Automobile Engineering

Sl. No	Code	Course	Study Scheme			Evaluation Scheme						Total Marks	Credit	
			Pre-requisite	Contact Hour/Week			Theory			Practical				
				L	T	P	End Exam	Progressive Assessment		End Exam	Progressive Assessment			
						Class Test		Assignment			Sessional	Viva		
48	AE601	Vehicle Surveying and Accidental Repair		3	0	2	75	10	15	25	0	25	150	5
49	AE 602	Retrofitting in Motor Vehicle		3	0	2	75	10	15	25	0	25	150	5
50	AE603	Tyre Maintenance and Retreading		3	0	2	75	10	15	25	0	25	150	5
51	AE 604	Agriculture and Earth Moving Machinery		3	0	2	75	10	15	25	0	25	150	5
52	AE 605	Two Wheeler Production and Maintenance		3	0	2	75	10	15	25	0	25	150	5
TOTAL				6	0	4	150	20	30	50		50	300	10

BASIC TECHNOLOGY COURSES

AUTOMOBILE DRAWING

L T P
1 0 3

Curri. Ref. No. AE401

Total Contact hrs.: 60

Total marks: 100

Theory:

Theory: 15

End Term Exam: 50

Practical : 45

P.A.: 0

Prerequisite: Nil

Practical:

Credit: 3

End Term Exam:

P.A.: 50

RATIONALE:

An Automobile Engineering diploma holder, irrespective of his field of operation in an industry or transport undertaking, is expected to possess a thorough understanding of engineering drawing, which includes clear spatial visualization of the subject and the proficiency in reading and interpreting a wide variety of drawings. Besides this, he is also expected to have a certain degree of drafting skills depending upon his job functions to perform his day-to-day activities e.g. communicating and discussing the ideas with his superiors and passing on instructions to his subordinates in an unambiguous way. The teachers are recommended to lay emphasis on showing automobile components to students.

UNIT TOPIC / SUB-TOPIC	Periods
1. LIMITS AND FITS Limit, tolerance, deviation, allowance, fits: clearance, interference, transition fit, Hole and shaft basis system.	1
2. ASSEMBLY DRAWINGS OF THE JOINTS AND BEARINGS: - Universal joint - Slip joint - Bush bearing - Plummer block or pedestal bearing - Ball bearing - Roller bearing- Straight and Needle type	2
3. ENGINE COMPONENTS - Four Stroke Petrol Engine Piston - Diesel Engine Piston - Connecting rod - Fuel injector - Fuel Pump –AC mechanical type - Overhead and side valve mechanism (free hand) - Crank shaft – 4 cylinder Engine - Spark Plug (free hand)	3
4. CHASSIS COMPONENTS - Leaf Spring suspension - Shock absorber - Wheel cylinder	2

- Master Cylinder
 - Brake drum (assembly)
 - Single plate clutch
5. **GEARS** 2
- Nomenclature of gears
 - Profile of spur gear by 'Approximate method'
 - Profile of spur gear by "Unwin's Method"
6. **CAM PROFILE** 3
- Different types of cams and followers
 - Drawing of cam profile for following motion of follower
 - (a) Uniform velocity motion
 - (b) Simple harmonic motion (SHM)
 - (c) Uniformly accelerated and retarded motion.
7. **AUTO ELECTRIC CIRCUITS(FREE HAND SKETCHES)** 2
- Battery ignition system
 - Magneto ignition system
 - Lighting system
 - Wiring diagram of a car
 -

SUGGESTED LIST OF PRACTICALS 45

1. Limits and Fits (01 sheet)
 Limit, tolerance, deviation, allowance, its: clearance, interference, transition fit, Hole and shaft basis system.

Assembly Drawings of the following automotive components:

1. Joints and Bearings (04 sheets)
- Universal joint,
 - Slip joint
 - Bush bearing
 - Plummer block or pedestal bearing
 - Ball bearing
 - Roller bearing- Straight and Needle type
2. Engine Components (06 sheets)
- Four Stroke Petrol Engine Piston
 - Diesel Engine Piston
 - Connecting rod
 - Fuel injector

- Fuel Pump –AC mechanical type
 - Overhead and side valve mechanism (free hand)
 - Crank shaft – 4 cylinder Engine
 - Spark Plug
3. Chassis components (05 sheets)
- Leaf Spring suspension
 - Shock absorber
 - Wheel cylinder
 - Master Cylinder
 - Brake drum (assembly)
 - Singe plate clutch
4. Gears
- Nomenclature of gears (2 sheets)
 - Profile of spur gear by ‘Approximate method’
 - Profile of spur gear by “Unwin’s Method’
5. Cam Profile (3 sheets)
- Different types of cams and followers
 - Drawing of cam profile for following motion of follower
 - (c) Uniform velocity motion
 - (d) Simple harmonic motion (SHM)
 - (c) Uniformly accelerated and retarded motion.
6. Auto Electric Circuits(free hand sketches) (2 sheets)
- Battery ignition system
 - Magneto ignition system
 - Lighting system
 - Wiring diagram of a car

REFERENCE BOOKS

1. RB Gupta *Auto Engineering Drawing* Satya Parkashan, New Delhi
2. Raj Kumar *Automobile Engg. Drawing* North Publication, Jalandhar
3. PS Gill *Machine Drawing* BD Kat aria and Sons, Ludhiana
4. Lakshminarayan *Machine Drawing* Jain Brothers, New Delhi
5. Dr. Kirpal Singh *Automobile Engineering- Vol. I and II* Standard Pulishers Distributors, Delhi

MANUFACTURING PROCESSES

L T P
3 0 0

Curri. Ref. No. AE 402

Total Contact hrs.: 45

Total marks: 100

Theory:

Theory: 45

End Term Exam: 75

Practical : Nil

P.A.: 25

Prerequisite: Nil

Practical:

Credit: 3

End Term Exam: 0

P.A.: 0

RATIONALE:

Engineering basically means production of goods and services for human consumption. The knowledge of various manufacturing processes lead to production of Automobile vehicles assembled with large number of parts, which are made from different metallic and non-metallic materials. These parts are produced using a variety of manufacturing processes with requisite strength, surface finish, size and shape. As an automobile technician/ engineer, one should have the knowledge of these manufacturing processes, which will be very helpful for discharging his duties in manufacturing or maintenance area of auto-vehicles.

UNIT TOPIC / SUB-TOPIC	Periods
1.0 PATTERN MAKING AND MOULDING	5
1.1 Pattern, pattern planning, pattern material, types of pattern, finishing and pattern (including colour codes)	
1.2 Allowances of pattern, stop off, placement of pattern in mold	
1.3 Types of mouldings sand and their properties, testing of sand moulding tools and moulding machines	
1.4 Cores – functions, classifications, core making, core hardening, finishing of core	
1.5 Moulding processes (like bench, floor, pit, stack, green sand, dry sand)	
2.0 CASTING	5
2.1 Types of casting process – Die casting, centrifugal casting, vacuum casting processes	
2.2 Pouring and feeding of casting	
2.3 Gating system	
2.4 Chills in casting	
2.5 Cleaning, finishing and heat treating of casting	
2.6 Defects in casting (causes and remedies)	
2.7 Inspection and testing of casting	
3.0 HOT AND COLD WORKING PROCESSES	7
3.1 Classification of hot and cold working process	
3.2 Forging (different methods, applications, advantages, limitations)	

3.3 Forging (types of machines and their constructional features, forging sequences for connecting rod, crank shaft etc.)	
3.4 Extrusion – type of extrusion machines, classification of extrusion processes)	
3.5 Other processes – Wire drawing, rolling, sheet metal blanking, forming	
4.0 FABRICATION	5
4.1 Preparation for fabrication	
4.2 Screwed fastening	
4.3 Riveted joints	
4.4 Soldered joints –soft and hard	
4.5 Aluminium brazing	
4.6 Fusion Welding	
4.7 Resistance welding	
4.8 Adhesive bonding	
4.9 Plastic welding techniques	
5.0 MACHINING PROCESSES	7
5.1 Turning	
5.2 Milling	
5.3 Rough Boring	
5.4 Drilling	
5.5 Gear Cutting	
5.6 Broaching	
5.7 Slotting	
5.8 Spline Cutting	
5.9 Shaping	
7.0 HEAT TREATMENT	4
7.1 Stress relieving	
7.2 Carburising	
7.3 Case Hardening & Tempering	
7.4 Annealing & Normalizing	
7.5 Surface Treatments	
7.6 Shot blasting	
8.0 FINISHING OPERATIONS	5
8.1 Gear shaving	
8.2 Grinding	
8.3 Lapping	
8.4 Honing	
8.5 Reaming	
8.6 Line boring	

9.0 SPECIAL MACHINES/SYSTEMS

7

- 9.1 CNC Machines
- 9.2 Electro discharge machines
- 9.3 Special purpose machines
- 9.4 Flexible manufacturing system

REFERENCE BOOKS

1. R. L. Timings *Manufacturing Technology (Vol.I & Vol II)* Pearson
2. Chapman, Arnold *Workshop Technology (Vol.1,II,III)*
3. S. K. Hazra Choudhury *Workshop technology (part-1,II,III)* Media Promoters and Publications Pvt. Ltd.
4. P. N. Rao *Manufacturing Technology* TMH.
5. S. Kalpakjian *Manufacturing Engineering and Technology* Addison-Wesley Publishing Co.
6. H. Gerling *All About Machine Tools* New Age International (P) Ltd.

STRENGTH OF MATERIALS AND MACHINE DESIGN

L T P
3 0 0

Curri. Ref. No. AE 403

Total Contact hrs.: 45

Total marks: 100

Theory:

Theory: 45

End Term Exam: 75

Practical : Nil

P.A.: 25

Credit: 3

Practical:

End Term Exam: 0

P.A.: 0

RATIONALE:

Machine parts are subjected to various types of loads resulting in development of stresses and strains. If, these stresses and strains are allowed to develop beyond the safe limit, the concerned part may fail. As a technician, it becomes very essential to understand the effects of loads on any part. Reduction in size with superior material strength are the main considerations of the present day manufacturing world. All these factors are focusing the attention of the technicians and engineers for need based designs by studying the effects of loads, stresses and strains in the parts and find necessary solutions. Machine design is the art of planning or devising new or improved machines to accomplish specific purposes. Idea of design is helpful in visualizing, specifying and selection of parts and components which constitute a machine. Hence all mechanical engineers should be conversant with the subject.

UNIT TOPIC / SUB-TOPIC	Periods
1.0 STRESSES AND STRAINS	4
1.1. Concept of load, stresses and strain	
1.2. Tensile, compressive and shear stresses and strains	
1.3. Concept of Elasticity, Elastic limit and limit of proportionality.	
1.3.1. Hook's Law	
1.3.2. Young Modulus of elasticity	
1.3.3. Nominal stress	
1.3.4. Yield point, plastic stage	
1.3.5. Ultimate strength and breaking stress	
1.3.6. Percentage elongation	
1.3.7. Proof stress and working stress	
1.3.8. Factor of safety	
1.3.9. Shear modulus	
1.4. Longitudinal and circumferential stresses in seamless thin walled cylindrical shells (derivation of these formulae not required)	
2.0 RESILIENCE	3
2.1 Resilience, proof resilience and modulus of resilience	
2.2 Strain energy due to direct stresses	
2.3 Stresses due to gradual, sudden and falling load	
3.0 BENDING MOMENT AND SHEARING FORCE	3.1

Concept of beam and form of loading

- 3.2 Concept of end supports-Roller, hinged and fixed
- 3.3 Concept of bending moment and shearing force
- 3.4 B.M. and S.F. Diagram for cantilever and simply supported beams with and without overhang subjected to concentrated and U.D.L.

4.0 BENDING STRESSES **6**

- 4.1 Concept of Bending stresses
- 4.2 Theory of simple bending
- 4.3 Use of the equation $f/y = M/I = E/R$
- 4.4 Concept of moment of resistance
- 4.5 Bending stress diagram
- 4.6 Calculation of maximum bending stress in beams of rectangular, circular, and T section.
- 4.7 Permissible bending stress Section modulus for rectangular, circular and symmetrical I section.

5.0 COLUMNS **4**

- 5.1 Concept of column, modes of failure
- 5.2 Types of columns
- 5.3 Buckling load, crushing load
- 5.4 Slenderness ratio
- 5.5 Factors effecting strength of a column
- 5.6 End restraints
- 5.7 Effective length
- 5.8 Strength of column by Euler Formula without derivation
- 5.9 Rankine Gourdan formula (without derivation)

6.0 TORSION **4**

- 6.1 Concept of torsion- difference between torque and torsion.
- 6.2 Use of torque equation for circular shaft
- 6.3 Comparison between solid and hollow shaft with regard to their strength and weight.
- 6.4 Power transmitted by shaft
- 6.5 Concept of mean and maximum torque

7.0 SPRINGS **5**

- 7.1. Closed coil helical springs subjected to axial load and impact load
- 7.2 Stress deformation
- 7.3 Stiffness and angle of twist and strain energy
- 7.4 Proof resilience
- 7.5 Laminated spring (semi elliptical type only)
- 7.6 Determination of number of plates
- 7.7 Material used for helical spring

- 7.8 Standard size of spring wire
- 7.9 Terms used in compression spring

8.0 DESIGN OF FASTENING ELEMENTS

5

- 8.1 Nomenclature, form of threads & specifications
- 8.2 Nature of loads and failure of bolt subjected to initial stresses due to screwing up, stresses due external forces, stresses due to combined force and stresses due to shear load
- 8.3 Dimensions of bolt and nut by using empirical formula. (Hexagonal & square nut)
- 8.4 Types of welded joints
- 8.5 Types of riveted joint
- 8.6 Failure of riveted joints
- 8.7 Strength & efficiency of riveted joints

9.0 DESIGN OF SHAFTS, KEYS & COUPLINGS

5

- 9.1 Function of shafts
- 9.2 Materials for shafts
- 9.3 Solid & hollow shafts to transmit a given power at given rpm based on
 - (a) Strength.
 - (i) Shear stress
 - (ii) Combined bending & tension
 - (b) Rigidity
 - (i) Angle of twist
 - (ii) Deflection
 - (iii) Modulus of rigidity
- 9.4 Standard size of shaft as per I.S.
- 9.5 Function of keys, types of keys & material of keys.
- 9.6 Failure of key, effect of key way.
- 9.7 Function of coupling and types of couplings
- 9.8 Determine the dimension for a C.I flange coupling and coupling bolts for a given torque by using empirical relations

10.0 DESIGN OF BELT DRIVES AND PULLEYS

5

- 10.1 Types of belt drives
- 10.2 Formulae for length of open and crossed belts, ratio of driving and driven side tension, centrifugal tension and relation between centrifugal tension and tension on tight side for maximum power transmission.
- 10.3 Belt thickness and width for given permissible stress for open and crossed belts considering centrifugal tension.
- 10.4 Types of pulleys for flat belts
 - 10.4.1 Cast iron pulley
 - 10.4.2 Steel pulley
 - 10.4.3 Fast and loose pulley

- 10.5 Design a cast iron pulleys using empirical formula only.
 - 10.5.1 Dimensions of pulley
 - 10.5.2 Dimensions and number of arms
 - 10.5.3 Dimension of hub
 - 10.5.4 Problems.

REFERENCE BOOKS:

1. Ramanutham *Strength of Materials* Dhanpat Rai & sons
2. D. R. Malhotra & H. C. Gupta *Elements of Strength of Materials* Satya Prakashan, New Delhi.
3. R. S. Khurmi and Gupta *Machine Design* Eurasia Publishing House.
4. Sharma and Agarwal *A Text Book of Machine Design* S. K. Kataria & Sons.
5. R. B. Gupta *Machine Design* Satya Prakashan.
6. Pandey and Shah *Elements of Machine Design* Charotar Publishing Housing.

THEORY OF MACHINES

L T P
3 0 0

Curri. Ref. No. AE 404

Total Contact hrs.: 45

Total marks: 100

Theory:

Theory: 45

End Term Exam: 75

Practical : Nil

P.A.: 25

Credit: 3

Practical:

End Term Exam: 0

P.A.: 0

RATIONALE:

In automobiles, the chemical energy of the fuel is converted into mechanical energy in the engine from the sliding motion of the piston to the rotary motion of crankshaft. From crankshaft to the wheels the motion is transmitted through a series of mechanisms. Besides this power transmission, the automobile is operated with the help of several mechanisms, like steering, brake, clutch and Accelerator mechanisms. These mechanisms are prepared with the help of linkages, gears, belt drives, etc. As a technician, one should have the necessary knowledge and skills about these mechanisms for manufacturing, operation and mechanisms of automobiles. This subject deals with different kinds of mechanisms and their applications.

UNIT TOPIC / SUB-TOPIC	Periods
1.0 FUNDAMENTALS	4
1.1 Definitions of statics, kinetics, kinematics & dynamics	
1.2 Kinematics links & their types	
1.3 Kinematics pairs & their types	
1.4 Kinematics chains & their types	
1.5 Constrained motions & their types	
1.6 Mechanisms, Inversions, Machines, Structures	
2.0 TYPES OF MECHANISMS	6
2.1 Laws of inversions	
2.2 Single slider crank chain & its inversions like Hand pump mechanism, Oscillating	
2.3 Cylinder engine mechanism, Quick return mechanism, Rotary I.C. engine mechanism.	
2.4 Double slider crank chain mechanism & its inversions like scotch yoke mechanism	
2.5 Oldham's coupling, Elliptical trammel	
2.6 Four bar chain mechanism & its inversions like Coupling of locomotives, Watt's	
2.7 Indicator mechanism, pantograph	
3.0 COMMON MECHANISMS	5
3.1 Bicycle rear wheel sprocket mechanism	
3.2 Mechanism of two stroke I.C. Engine	
3.3 Reciprocating air compressor mechanism	
3.4 Crane mechanism (winch) with worm & worm gear box, spur gear box, with brakes.	
3.5 Steering mechanism of automobiles	

3.6 Shaper quick return mechanism	
4.0 VELOCITY & ACCELERATION IN MECHANISMS	5
4.1 Concept of the velocity diagram of the mechanisms by relative velocity method	
4.2 Concept of forces acting on mechanisms & Mechanical advantage	
4.3 Concept of centripetal & tangential Acceleration	
4.4 Acceleration diagrams of Four bar & Slider crank mechanisms	
4.5 Analytical method for Velocity & Acceleration	
4.6 Klein's & Modified construction for Velocity & Acceleration	
5.0 CAMS & FOLLOWERS	5
5.1 Concept & definitions of cams & followers	
5.2 Types & classifications of cams & followers	
5.3 Different follower motions, their displacements like uniform velocity, SHM, Uniform	
5.4 Acceleration & retardation	
5.5 Drawing of profiles of plate cams by graphical method	
6.0 POWER TRANSMISSION DEVICES	8
6.1 Belts & belt drives, types of belts, belt material, velocity ratio of belt drive	
6.2 Slip & creep	
6.3 Determination of tension ratio in belt drives, lengths of belts, Power transmission.	
6.4 Initial tension, centrifugal tension, condition for maximum power transmission	
6.5 Rope drives- Their types, advantages, limitations, applications	
6.6 Chain drives- Elements & composition of chain drives, their comparison with other drives, characteristics of chain drive	
6.7 Gears & Gear trains- Concept of friction wheel applications, Basic gear terminology	
6.8 Gear, types of gears & its applications, laws of gearing, gear trains & their types	
7.0 BRAKES & DYNAMOMETERS	5
7.1 Functions of brakes, types of brakes, block brakes, band brake, combined block & band brakes	
7.2 Relationship of braking torque & braking force in each case	
7.3 Internal expanding brake, hydraulically operated pneumatically operated, vacuum brakes.	
7.4 Concepts, principles & working of dynamometers such as Prony brakes & Rope brake- dynamometers, Eddy current dynamometers, transmission types such as belt & torsion- dynamometers, Hydraulic dynamometer	
8.0 FRICTION & CLUTCHES	7
8.1 Types of friction, laws of friction, uses of friction	
8.2 Types of bearings, simple Pivot & collar bearing, Conical pivot bearing	
8.3 Relationship of torque & power by uniform pressure & wear theory with simple numericals	

REFERENCE BOOKS

1. P. L. Ballaney *Theory Of Machine* Khanna Publishers
2. Khurmi-Gupta *Theory Of Machines* Eurasia Home
3. J. E. Shigley *Theory Of Machines* Mcgraw Hill
4. Timoshenko *Theory Of Machines* Wiley-Eastern

HEAT POWER ENGINEERING

L T P
3 0 0

Curri. Ref. No. AE 405

Total Contact hrs.: 45

Total marks: 100

Theory:

Theory: 45

End Term Exam: 75

Practical : Nil

P.A.: 25

Credit: 3

Practical:

End Term Exam: 0

P.A.: 0

RATIONALE:

Heat power engineering is the field of applied science which deals with the energy possessed by heated gasses and vapours, and the laws which govern the conversion of this energy into mechanical energy and vice versa. This is the fundamental subject for understanding the process of producing vast amount of mechanical energy from heat energy and therefore necessary to be learned by all engineering students.

UNIT TOPIC / SUB-TOPIC	Periods
1.0 THERMODYNAMIC CONCEPT AND PROPERTIES	5
1.1 Energy	
1.2 The sources of energy	
1.2.1 Conventional energy (thermal, mechanical)	
1.2.2 Non-conventional energy	
1.3 Explain various thermodynamic systems	
1.3.1 Closed system	
1.3.2 Open system	
1.3.3 Isolated system	
1.3.4 Thermodynamic equilibrium condition	
1.3.5 Quasistatic process	
1.3.6 Thermodynamic properties, process and cycle	
1.4 Thermodynamic properties (intensive ,extensive)	
1.5 Thermodynamic properties (pressure , volume ,temp ,internal energy-enthalpy)	
1.6 Heat, work & state their units	
1.7 Mechanical equivalent of heat	
1.8 Specific heat	
1.8.1 specific heat at constant vol. (Cv)	
1.8.2 specific heat at constant pressure (Cp)	
1.9 Relationship between Cp and Cv (no proof)	
2.0 PROPERTIES, PROCESSES OF IDEAL GAS	3
2.1 Difference between ideal gas & real gas	
2.2 Difference between gas & vapour	
2.3 Boyle's law, Charles law, Guy Lussac law & combined gas equation (with problems)	
2.4 Characteristic gas const., Universal gas constant (with problems)	
2.5 Various non-flow thermodynamic processes and solve problems on	

- 2.5.1 Isothermal process
- 2.5.2 Isobaric Process
- 2.5.3 Isochoric process
- 2.5.4 Isentropic process
- 2.5.5 Polytropic process

3.0 LAWS OF THERMODYNAMICS

5

- 3.1 Zeroth law of thermodynamics.
- 3.2 First law of thermodynamics.
- 3.3 Application of first law to of thermodynamics non_ flow process & solve simple problems on:
 - 3.3.1 Const pr. Process
 - 3.3.2 Const vol. process
 - 3.3.3 Adiabatic process
 - 3.3.4 Isothermal process
- 3.4 Application of first law of thermodynamics to steady flow process & general energy equation applied to condenser, nozzle, turbine.
- 3.5 Explain the limitation of 1st law of thermodynamics
- 3.6 State and explain second law of thermodynamics
 - 3.6.1 Heat engine ,efficiency ,heat pump ,refrigerator, & C.O.P
 - 3.6.2 State Kelvin-Planks statement.
 - 3.6.3 State Clausius statement
 - 3.6.4 Equivalence of two statements
- 3.7 Explain reversible and irreversible process and highlight causes of irreversibility
- 3.8 Clausius inequality
- 3.9 Entropy
- 3.10 Principle of increase of entropy

4.0 INTERNAL COMBUSTION ENGINE

7

- 4.1 Air standard cycle
 - 4.1.1 Otto cycle
 - 4.1.2 Diesel cycle
 - 4.1.3 Dual –combustion cycle
- 4.2 The air standard efficiency of above cycles, do some related problems
- 4.3 Classification of I.C engines
- 4.4 Various I.C engine parts & their functions
- 4.5 The terminology of I.C engine such as bore , dead centers, stroke
Compression ratio, clearance vol., Stroke vol. Piston speed and R.P.M.
- 4.6 The working principle of 2-stroke ,4-stroke C.I & S.I Engine with valve timing diagram
- 4.7 Differentiation between 2-stroke ,4 –stroke engine
 - 4.7.1 Difference between S.I & C.I Engine
- 4.8 Performance testing of I.C engine
 - 4.8.1 Determination of I.H.P ,B.H.P and F.H.P & mechanical efficiency , indicated thermal efficiency , brake thermal efficiency, specific fuel combustion

5.0 AIR COMPRESSOR

5

- 5.1 The function of compressor and industrial use of compressed air
- 5.2 Classification of air compressor

5.3	The construction and working principle of Reciprocating air compressor	
5.4	The terminology of reciprocating compressor such as bore , stroke, clearance volume, swept volume , piston speed , pressure ratio, free –air delivered and volumetric efficiency	
5.5	The work done of a single stage & two stage compressor with and without clearance	
5.6	The volumetric efficiency of reciprocating compressor	
5.7	Determination of the dimension (stroke length , diameter) of two stage compressor	
6.0	PROPERTIES AND PROCESSES OF VAPOUR	3
6.1	Difference between gas and vapour	
6.1.1	Formation of steam	
6.1.2	Representation in p-v and t-s diagram	
6.2	Definition and properties of steam	
6.2.1	Steam chart, Mollier diagram	
6.2.2	Non flow and flow processes of vapour	
6.2.3	P-V, t-s and h-s diagram	
6.3	Steam calorimeter	
7.0	REFRIGERATION	5
7.1	Air Refrigeration cycle	
7.1.1	Definition Refrigeration	
7.1.2	methods of Refrigeration	
7.1.3	Unit of Refrigeration, C.O.P	
7.1.4	Carnot cycle , reversed Carnot cycle , Bell Coleman cycle and derive the C.O.P with simple problems	
7.1.5	Open air and closed air refrigeration system	
7.2	Vapour compression system.	
7.2.1	The principle and analysis of vapour comp. Refrigeration system with help of P-H, T-S diagram, simple problem	
7.2.2	Different types of Refrigerant with their properties (Ammonia , CO ₂ ,F-11, F-12 etc.)	
7.2.3	The working principle of Ice -plant, cold storage, domestic Refrigerator	
7.3	Vapour Absorption system	
7.3.1	The working principle of vapour absorption system	
7.3.2	The working principle of Electrolux Refrigeration	
8.0	AIR CONDITIONING	5
8.1	The purpose of air conditioning	
8.2	The Psychrometric terms (dry air, moist air, saturated air, humidity, absolute humidity, D.B.T , W.B.T , D.P.T)	
8.3	Study of Psychrometric chart	
8.4	Psychrometric process	
8.4.1	Sensible cooling , sensible heating , humidification, dehumidification	
8.5	Comfort air conditioning	
8.6	Working principle of summer air conditioning system and winter air conditioning system	

9.0 HEAT TRANSFER

4

9.1 Introduction

9.2 Basic idea on modes of heat transfers (no mathematical treatment)

9.2.1 Conduction.

9.2.2 Convection.

9.2.3 Radiation.

9.3 The basic concept of Fourier's law and thermal conductivity

9.4 The heat exchange phenomenon

9.5 The types of (free, forced) heat convection

9.6 The properties of heat radiation (no mathematical derivation)

9.6.1 Kirchoff law.

9.6.2 Stefan Boltzman law

10.0 GAS TURBINE

3

10.1 Advantages of Gas turbine over steam turbine & I.C engine.

10.2 Constant pressure gas turbine.

10.3 Constant volume gas turbine.

10.4 Closed cycle and open cycle gas turbine.

REFERENCE BOOKS:

1. Domkundwar *Thermal Engineering* S. Chand , New Delhi
2. M L Mathur and Sharma *IC Engines* Dhanpat Rai and Sons, Delhi
3. Ballaney *Thermal Engineering* Dhanpat Rai and Sons, Delhi
4. P. K. Nag *Engineering Thermodynamics* Tata McGraw Hill

FLUID MECHANICS AND MACHINES

L T P
3 0 3

Curri. Ref. No. AE 406

Total Contact hrs.: 90

Total marks: 150

Theory:

Theory: 45

End Term Exam: 75

Practical : 45

P.A.: 25

Credit: 5

Practical:

End Term Exam: 25

P.A.: 25

RATIONALE:

Use of fluids in engineering field is of great importance. It is therefore necessary to study the physical properties and characteristic of fluids which have very important use and application in automobile engineering.

Actual use of or action by various liquids like water and oil can be realized by a group of machines called fluid machines. Automobile students should be conversant with design, operation and use of these hydraulic machines.

UNIT TOPIC / SUB-TOPIC	Periods
1.0 PROPERTIES OF A FLUID	5
1.1 Definition of a fluid	
1.2 Classification of fluids	
1.3 Various fluid properties such as density, specific weight, specific gravity, viscosity and surface tension and state the units	
1.4 Definition fluid pressure	
1.5 Definition total pressure (hydrostatic force)	
1.5.1 Total pressure and location of centre of pressure on vertical, horizontal ,inclined and curved surfaces by fluid	
1.6 Working of various measuring devices for pressure	
1.7 Solve numerical problem involving the principle of manometers of simple , differential and inverted types	
1.8 Principle of buoyancy and floatation	
2.0 BERNOULLI'S EQUATION & ITS APPLICATION	5
2.1 Various types of flow	
2.2 Equation of continuity for one-dimensional flow	
2.3 Various energies of fluid	
2.4 Bernoulli's theorem	
2.5 The limitations of same-application of Bernoulli's equation	
2.6 The working of venturimeter, pitot tube	
2.7 Equation of flow rate and velocity with respect to venturimeter and pitot tube respectively.	
2.8 The working of flow meter : current meter	
3.0 FLOW THROUGH ORIFICES AND NOTCHES	3
3.1 Define orifices.	
3.2 Classify orifices.	

- 3.3 Define orifice coefficient such as C_c , C_v , C_d
- 3.4 Establish the relation between orifice coefficients
- 3.5 Define weir and notch.
- 3.6 States the types of weir and notch
- 3.7 Differentiate between weir and notch
- 3.8 Formula for the discharge over rectangular notch & weir (no proof)
- 3.9 Formula for the discharge over triangular notches (no proof)
- 3.10 Solve numerical problems on above

4.0 FLOW THROUGH PIPES **5**

- 4.1 Definition of a Pipe. Laws of fluid friction
- 4.2 The equation of loss of head through pipe due to friction (no proof)
- 4.3 Darcy's formula and Chezy's formula (no proof)
- 4.4 Hydraulic gradient and total energy line
- 4.5 Nozzle & its application
- 4.6 The expression of Power transmission through nozzle (no proof)
- 4.7 The condition of maximum power transmission through nozzle (no proof)
- 4.8 The expression for diameter of nozzle for maximum power transmission (no proof)

5.0 IMPACT OF JET **4**

- 5.1 Impact of jet on flat surface
 - 5.1.1 Impact of jet on fixed flat plate
 - 5.1.2 Numerical problem on above
- 5.2 Impact of jet and work done on moving flat plates
 - 5.2.1 Impact of jet and work done on series of flat plates fixed on rim of a cylinder
 - 5.2.1.1 The condition for maximum hydraulic efficiency out of such system (no proof)
- 5.3 Velocity triangle for jet impinging tangentially in curved vane
 - 5.3.1 Estimation of work done and efficiency of above system (no proof)

6.0 TURBINES **5**

- 6.1 Definition water turbine
- 6.2 Classification water turbine
- 6.3 Construction details and working of Pelton wheels
 - 6.3.1 Velocity triangle for a single bucket
 - 6.3.2 Estimation of work done and efficiencies for Pelton wheels (no deduction)
- 6.4 Construction details and working of Francis turbine
 - 6.4.1 Velocity triangle for Francis turbine
 - 6.4.2 Estimation of work done and efficiencies for Francis turbine (no deduction)
 - 6.4.3 Velocity triangle for inward and outward flow reaction turbines
- 6.5 Construction details and working of Kaplan turbine
- 6.6 Governing of hydraulic turbines
- 6.7 The working of Surge tanks and draft tubes
- 6.8 The criteria for selection of hydraulic turbines
- 6.9 Solve numerical problems involving quantity of water, head, power and efficiency

7.0 PUMP	5
7.1 Definition & Classification of pumps	
7.1.1 Centrifugal pumps	
7.2 Construction and working of Centrifugal pump	
7.2.1 Various types of Casings, such as volute, vortex and different user types	
7.3 Velocity triangle for a single vane of impeller	
7.4 Computation of the work done for same.	
7.4.1 Definition of various heads of centrifugal pumps	
7.4.2 Manometric efficiency, mechanical efficiency and over all efficiency of centrifugal pump	
7.4.3 Solve numerical problems on above	
7.5 The expression for minimum starting speed (no proof)	
7.6 The working of multistage pumps	
7.7 Priming of centrifugal pumps with various priming procedure used	
7.8 The method of prevention of air intake for centrifugal pumps	
8.0 RECIPROCATING PUMPS	5
8.1 Construction and working of single acting reciprocating pump	
8.1.1 Describe construction and working of double acting reciprocating pump	
8.2 Definition of slip	
8.2.1 Positive & negative slip	
8.2.2 Establishment of relationship between slip & coefficient of discharge	
8.3 The formula for HP required to drive (no proof)	
8.3.1 Single acting reciprocating pump	
8.3.2 Double acting reciprocating pump	
9.0 OIL HYDRAULICS	5
9.1 Basic principle of enclosed hydraulic system –Pascal’s law	
9.2 Various components of oil hydraulic system – reservoir, filter , pressure limiting valves, direction control valves, flow control valves, actuators (linear & rotary), accumulator, pipes and fittings , symbols used	
9.3 Principle of operation of various positive displacement pumps-gear, vane, piston	
9.4 Hydraulic circuit drawing for a few typical applications like extension and retraction of linear actuator, motion of rotary actuator, holding a job, hydraulic press etc.	
10 HYDRAULIC DEVICES	3
10.1 Construction, working principles and applications of simple and differential accumulator	
10.2 Intensifier, hydraulic jack, hydraulic ram, hydraulic lift, hydraulic press	

SUGGESTED LIST OF LAB. EXPERIMENTS

45

- 1 Determination of mass, density of liquid
- 2 Determination of weight, Density of liquid.
- 3 Determination of specific Gravity of liquid.
- 4 Identify and use of different manometers in the laboratory.
- 5 Identify and draw a neat-labeled diagram of different types of gauges used in hydraulic machinery lab
- 6 Verification of the continuity equation by using branched pipes/ different set of pipes.(use velocity measuring instruments).
- 7 Measurement of the flow by using notch.
- 8 Measurement the flow by using venturimeter, nozzle, orifice and pitot tube.
- 9 Determination loss of head per unit length of different pipe materials.
- 10 Performance study of a centrifugal pump
- 11 Performance study of reaction turbine
- 12 Performance study of pelton turbine
- 13 Study of submerged axi-symmetric jet

REFERENCE BOOKS:

1. Modi & Seth *Hydraulics & Hydraulic Machines* Standard Book.
2. A. K. Jain *Fluid Mechanics* Khanna Publishers.
3. Jagadish Lal *Hydraulics and Fluid Mechanics* Metropolitan Book
4. R.K Bansal *A Text book of Hydraulics, fluid mechanics and Hydraulic machines* Laxmi Publication.
5. S. R. Majumder *Oil Hydraulics* TATA MacGraw Hill

METROLOGY AND QUALITY CONTROL

L T P
3 0 3

Curri. Ref. No. AE 407

Total Contact hrs.: 90

Total marks: 150

Theory:

Theory: 45

End Term Exam: 75

Practical : 45

P.A.: 25

Credit: 5

Practical:

End Term Exam: 25

P.A.: 25

RATIONALE:

Diploma engineers often come across varied types of measuring instruments and quality control processes in the actual practice. Diploma engineer should be proficient in making the measurements and follow various control processes to maintain the quality in engineering manufacturing areas. He should be able to understand and analyze the practical measurement systems.

The course Metrology & quality control makes the students to understand the process of measurement and quality control processes required in any industry. Also the student should be able to use various measuring instruments, select the appropriate quality control processes for a particular application.

UNIT TOPIC / SUB-TOPIC	Periods
PART-I Metrology	
1.0 METROLOGY CONCEPTS & STANDARDS	4
1.1 Definition of Metrology common terminology used such as Accuracy, Precision, Sensitivity, Magnification, Errors, Sources of errors	
1.2 Line standard	
1.3 Wavelength standard	
2.0 BASIC PRECISE & NON PRECISE MEASURING INSTRUMENTS	4
2.1 Surface plate, angle plate, V Block, Spirit level, straight Edge, slip gauges	
2.2 pitch screw gauge, feeler gauge, Vernier caliper, vernier height gauge, vernier depth gauge, Outside micrometer, inside micrometer, slip gauge	
2.3 Concept of calibration	
3.0 LIMITS, FITS & GAUGES	4
3.1 Definitions -Tolerance, Allowance, Types of fits, Hole basic system & shaft	
3.2 Basic system of fits	
3.3 Types of gauges -Plug gauges, snap gauges, Ring gauges and relation Gauges	
3.4 Taylor's Principle of gauge design. Problems of Tolerance calculations	
3.5 Gauge design	
4.0 ANGULAR MEASUREMENTS	4
4.1 Concept of Angular measurement	

4.2	Construction & working of bevel protractor, sine bar angle gauges, clinometer	
4.3	Autocollimator, angle dekkor	
5.0	COMPARATORS	4
5.1	Principle of comparators, operation of various comparators	
5.2	Dial Indicators as mechanical comparator	
5.3	Pneumatic comparators - Solex type & high pressure dial type.	
5.4	Electrical comparators	
5.5	Relative advantages & disadvantages of various comparators & characteristics of good comparator	
6.0	SCREW THREAD MEASUREMENT	4
6.1	Terminology of screw thread	
6.2	Measurement of various parameters of screw thread such as major diameter, minor diameter, effective diameter, pitch using instruments – bench micrometer, screw thread micrometer, floating carriage micrometer, tool makers microscope, optical profile projector	
7.0	SURFACE FINISH MEASUREMENT	4
7.1	Terminology	
7.2	Importance of surface finish	
7.3	Concept of primary texture, secondary texture, CLA, RMS & RA Value	
7.4	Principle and operation of stylus probe instruments	
<i>PART-II Quality Control</i>		
8.0	FUNDAMENTAL OF STATISTICAL CONCEPTS	4
8.1	Classification of data, use and construction of frequency plot, frequency distribution	
8.2	Measures of central tendency- mean, mode, median and variability and application, measures of dispersion-range, mean deviations, standard deviations	
8.3	Areas under standard deviation, areas under normal distribution curve	
9.0	CONTROLS CHARTS FOR VARIABLES	5
9.1	Statistical basis for control charts for variables, chance causes and assignable causes	
9.2	Control charts –X & R chart	
9.3	Constructions of X & R charts and their interpretations	
9.4	Analysis of X and R chart	
9.5	Standard error chart (S- chart)	
10.0	CONTROL CHARTS FOR ATTRIBUTES	5
10.1	Types of attribute charts, characteristics and their limitations	
10.2	Calculations constructions, interpretations and applications of P-Charts, Pn- charts and C-Charts	
11.0	ACCEPTANCE SAMPLING AND WORK SAMPLING	3
11.1	Different techniques for accepting of material, procedure involved, sampling inspection and comparison with 100% inspection	
11.2	Sampling risk, quality indices for acceptance sampling	

- 11.3 Comparison of attribute and variable type sampling
- 11.4 Definition, types of work sampling method
- 11.5 Source of errors in work (activity) sampling
- 11.6 Advantages and disadvantages of work sampling

SUGGESTED LIST OF LAB. EXPERIMENTS

45

1. Use of basic precision measuring instruments such as vernier caliper, vernier height gauge, vernier depth gauge, outside micrometer, inside micrometer for measurement of actual jobs from industry such as; Bearings, Cylinder block of scooter , Connecting rod, Crank shaft, Cam shaft, Crankcase of scooter etc.
2. Use of slip guage to find unknown gap
3. Use of sine centre to measure taper angle
4. Use of screw thread micrometer to measure effective diameter of screw thread & demonstration of bench micrometer and floating carriage micrometer for two wire method.
5. Use of tool makers microscope for screw thread measurement.
6. Use of Bevel protractor
7. Use of shewhart's bowl and actual production for frequency distribution
8. Preparation of X and Y control chart from population of shewhart's bowl and from actual production.
9. Preparation of P-chart
10. Preparation of C-chart

REFERENCE BOOKS AND LEARNING RESOURCES:

1. R. K. Jain *Engineering Metrology* Khanna Publishers
2. ASTM *Hand book of Industrial Metrology*
3. M. Mahajan *Statistical quality control* Dhanpat Rai & sons
4. Tapan. P. Bagchi, ISO 9000 *Concepts, Methods and Implementations* Wheeler
5. Codes of Practices by BIS
IS 919 - 1963 limits, fits & tolerances
IS 2029 - 1962 dial gauges

AUTOMOBILE ENGINE I

L T P
3 0 3

Curri. Ref. No. AE 408

Total Contact hrs.: 90

Total marks: 150

Theory:

Theory: 45

End Term Exam: 75

Practical : 45

P.A.: 25

Credit: 5

Practical:

End Term Exam: 25

P.A.: 25

RATIONALE:

As an automobile engineer/ supervisor, he/she should have the knowledge of the various systems of the engine and the necessary skills to assemble and disassemble the various units/ assemblies/ sub- assemblies of the automobile engine. Besides, a supervisor should be able to diagnose the faults and take corrective actions. This subject deals in such areas of automotive engines. The necessary information has been dealt in two subjects- Automobile Engine I & II. Automobile Engine I takes care of engine fundamentals, fuel system and exhaust system.

UNIT TOPIC / SUB-TOPIC	Periods
1.0 AUTO ENGINES	6
1.1 Indian Automobiles, Types of Automobiles, Layout, Components and functions of the Automobile	
1.2 Classifications of Automobile Engines: Use of Engines	
1.3 Merits and Demerits of vertical and Horizontal Engines	
1.4 Basic concepts of engine- TDC, BDC, Bore, Stroke, Mean effective pressure (MEP), IP, BHP, Engine torque, weight to power ratio, fuel efficiency (Kms./litre) and specific power output viz. BHP/litre.	
1.5 Reasons for Using Single-cylinder Two stroke Air Cooled Petrol Engine on Two Wheelers.	
1.6 Reasons for Using Multi-Cylinder Diesel Engine For Commercial Vehicles	
1.7 Merits and Demerits of Two Stroke and Four Stroke Cycle Engines	
1.8 Advantages of a Multi-cylinder Engine for the same power	
2.0 AUTOMOTIVE FUELS	6
2.1 Types of fuels & their origin	
2.2 General properties of automotive fuel & their constituents	
2.3 Specifications as per IS standards of Automotive fuels & their relevance in various structural & functional aspects of fuel system of auto engine	
2.4 Octane number, Octane rating of Automotive fuels	
2.5 Unleaded petrol-necessity & identification	
2.6 Vitality of conservation of convention fuels in the context of vehicular pollution and population & resource depletion	
2.7 Necessity of alternate energy sources – Properties & suitability of Alcohol, Benzole & other vegetable oils	
2.8 Additives in fuels & their roles	
2.9 Alternative Automobile fuels	

3.0 FUEL SYSTEM FOR PETROL ENGINE	8
3.1 Introduction	
3.2 Fuel System for Petrol Engine	
3.3 Gravity Feed System	
3.4 Fuel Pumps	
3.5 Properties of Air Fuel Mixture	
3.6 Engine Requirements	
3.7 Throttle valve	
3.8 Carburetors - Limited use of Carburetors in modern car -reason	
3.9 Classification of Petrol fuel Injection System	
3.10 Advantage of Port Fuel Injection or Multipoint Fuel Injection System	
3.11 Description of some Petrol Fuel Injection System	
3.12 Advantages and Disadvantages of Fuel Injection System	
4.0 COMBUSTION PROCESS IN DIESEL ENGINES	7
4.1 Introduction	
4.2 Properties of Diesel Fuel	
4.3 Combustion Process in C.I.Engines	
4.4 Diesel Knock	
4.5 Types of C.I.Combustion Chambers	
4.6 Open Combustion Chamber	
4.7 Pre Combustion Chamber	
4.8 Turbulence Combustion Chamber	
4.9 Air Cell Combustion Chamber	
4.10 Energy Cell Combustion Chamber	
5.0 FUEL INJECTION EQUIPMENT FOR DIESEL ENGINE	5
5.1 Introduction	
5.2 Fuel Injection System	
5.3 Fuel Injection Pump for Diesel Engine	
5.4 Diesel Injector	
5.5 Governor	
6.0 TURBO CHARGING OF I.C. ENGINE	6
6.1 Location	
6.2 Construction & working	
6.3 Advantages & disadvantages	
6.4 Difference between turbo charging & supercharging	
7.0 AUTOMOBILE EMISSION AND ITS CONTROL	7
7.1 Emission Norms - Indian and Euro norms -Complete and Incomplete Combustion	
7.2 Constituents of Exhaust Gases	
7.3 Pollutant Formation	
7.4 Effect of Air Fuel Ratio on Exhaust Emission	
7.5 Effect of Driving Mode on Exhaust Emission	
7.6 Sources of Pollutants in an Automobile	
7.7 Control Approaches for Automobile Emission	

SUGGESTED LIST OF EXPERIMENTS/ DEMONSTRATIONS

45

1. Determination of fire point & flash point of given fuel
2. Open fuel system of given vehicle (Petrol), identify and check the components, draw the block diagram
3. Open fuel system of given vehicle (Diesel), identify and check the components, draw the block diagram
4. Dismantle various fuel pumps like – mechanical and electrical, identify and check the components
5. Dismantle diesel fuel injection pumps and injectors, identify the components, sketch and reassemble
6. Remove the cylinder head, observe the combustion chamber, location of valves, fuel injector, decarbonize combustion chamber, clean and refit
7. Performance of fuel filter change activity of a given vehicle.
8. Diagnose engine condition by exhaust gas analyzer.
9. Testing of emission of diesel vehicle.
10. Calibration of diesel fuel pumps and nozzles.

REFERENCE BOOKS:

1. Kirpalsingh *Automotive Engineering Vol I* Standard publishers and distributors, New Delhi.
2. Crouse & Anglin *Automotive Mechanics* McGraw Hills International Pub.
3. K. K. Jain & R. B. Asthana *Automobile Engineering* TMH
4. Don Knowles *Auto Mechanics-Understanding new technology* Reston Publishers, New Jersey.
5. Mathur & Sharma *Internal Combustion Engine* Dhanpat Rai & Sons, New Delhi.
6. Bosch *Diesel Fuel Injection* SAE (distributor)
7. Anthony E. Schwaller *Motor Automotive Technology* Delmar Publishers, USA.
11. Harban Singh Reyat *The Automobile* S. Chand & Co. Ltd.
12. G. B. S. Narang *Automobile Engineering* Khanna Publishers.
13. R. B. Gupta *Automobile Engineering* Satya Prakasha

AUTOMOBILE ENGINE II

L *T* *P*
3 0 3

Curri. Ref. No. AE 409

Total Contact hrs.: 90

Total marks: 150

Theory:

Theory: 45

End Term Exam: 75

Practical : 45

P.A.: 25

Credit: 5

Practical:

End Term Exam: 25

P.A.: 25

RATIONALE:

In automobile engine II, the different parts of the engine and other systems of the engine i.e., lubrication and cooling has been dealt. Besides these aspects, measurement of engine performance and testing of the engine has also been described.

UNIT TOPIC / SUB-TOPIC	Periods
1.0 ENGINE DETAILS - I	12
1.1 Construction of two stroke & four stroke engine	
1.2 Cylinder block – Two-wheeler (3 port, 5 port, 2 stroke, 4 stroke) Four-wheeler - inline and V type engine (Material, construction and manufacturing process)	
1.3 Failures in cylinder block, their causes, symptoms and remedies	
1.4 Cylinder Head – Two wheeler (2 stroke, 4 stroke), four-wheeler – loop flow, offset cross, and inline. (Material, construction and manufacturing process)	
1.5 Failures in cylinder head, their causes, symptoms and remedies	
1.6 Crankcase- Two-wheeler (2 stroke and 4 stroke), Four-wheeler (Material, construction and manufacturing process)	
1.7 Failures in crankcase, causes, symptoms and remedies	
1.8 Oil Pan– (Material, construction and manufacturing process)	
1.9 Failures in Oil pan, causes, symptoms and remedies	
1.10 Inlet manifold	
1.11 Failures in inlet manifold, causes, symptoms and remedies	
1.12 Exhaust Manifold - Individual cylinder and two in one (Material, construction and manufacturing process)	
1.13 Failures in Exhaust manifold, causes, symptoms and remedies	
1.14 Cylinder Liners – Dry type and wet type (Material, construction, manufacturing process and comparison)	
1.15 Failures in Cylinder Liners, causes, symptoms and remedies	
1.16 Piston – Functions, Construction details, Material, Typical temperature in SI & CI pistons. Heat dissipation– Slots in piston – Horizontal, vertical, inclined, T slot, Heat dam, Taper, Oval, Wire wound, Auto thermic, Bimetal, Offset	
1.17 Piston Failures viz. Scuffing (types), scored, Burnt land, Ring damage, Boss & Circlip groove damage. Symptoms, causes and remedies	

2.0 ENGINE DETAILS – II

12

- 2.1 Crankshaft– For two wheelers, for Four wheeler- In line & V engines, Vibration damper (Construction, manufacturing, working and location)
- 2.2 Failures in crankshaft – Bend, Pitting, Imbalance, wear.
- 2.3 Crankshaft bearings, types, arrangements and lubrication.
- 2.4 Connecting rod bearing in two-wheeler and four wheeler engines.
- 2.5 Failures, symptoms, cause, and remedies in bearing, reparability in bearing.
- 2.6 Flywheel - Construction, function, working and location
- 2.7 Engine Valves- Sleeve, poppet, disc, rotary and reed valve. (Construction, manufacturing, working and location)
- 2.8 Valve seats, valve guides and valve springs. (Construction, manufacturing, working and location)
- 2.9 Failures, symptoms, causes, remedies in valves and valves seats. Its Reparability and allowance
- 2.10 Valve actuating mechanisms– Cam in block and over head cam (OHC) arrangements (Construction, working, comparison)
- 2.11 Valve train components details – Camshaft, Chain and sprocket, Timing gears, Belt and pulley, Valve tappet – Fixed type, adjustable type, hydraulic type. Push rod, Rocker arm, Rocker Shaft, rocker stand and Valve Rotator – Free type, positive type (Construction, manufacturing, comparison, working and location).
- 2.12 Failures, symptoms, causes, remedies in Valves & Valve component, Settings, Timing, Tension adjustment and other settings. Valve troubles – Burnt face, Stem Necking, face wear, stem & guide wear, cracking, noisy operation & breakage
- 2.13 Piston Rings- Compression rings (First & Second) – Rectangular, Symmetric ,Barrel holed, Taper Face, Hooks scraper, Torsional twist, Reverse torsional, taper face, Keystone, Piston ring end gaps (Butt, Taper, Seal cut)(Construction, manufacturing, working and application) Oil Control Ring– Plain oil ring, Coil spring expander, backed cast iron oil ring, Bevelled ring, Stepped scraper, slotted scrapper, Double action scrapper, Composite rail scraper (Construction, manufacturing, working and location)
- 2.14 Failures, symptoms, causes, remedies in Piston rings viz. Rapid wear, Scuffing, Breaking
- 2.15 Piston Pins- Fixed, floating, semi floating (Construction, manufacturing, working and application)
- 2.16 Failures, symptom, causes, remedies in Piston Pins viz. Rapid wear, Scuffing
- 2.17 Connecting Rod– (Construction, manufacturing, working and location)
- 2.18 Failures, symptoms, causes, remedies in connecting rod.
- 2.19 Gaskets & Seals types - Cylinder head gaskets, manifold gaskets, water body gasket, oil pan gasket, crank case of two wheeler gasket, Carburettor gaskets, and radiator gasket. Seals– Spring-less, spring loaded, fluted, split rubber and rope type. (Construction, application, manufacturing)
- 2.20 Failures, symptom, causes and remedies in Seals & Gaskets.
- 2.21 Muffler- Baffle type, wave cancellation type, absorber type, reverse flow, combined resonance and observer type and acoustics tuning devices
- 2.22 Failures, symptoms, causes and remedies in Muffler viz. Choking, Rusting, Cracking, Proper fitting

2.23 Assignment - Study of auto manufacturers catalogue about above components

3.0 ENGINE DETAILS III **6**

- 3.1 Arrangement of Engine – Horizontal engine, inclined engine, vertical engine, inline engine, V-Engine, Radial engine, Opposed cylinder engine, U-Engine, Opposed direction engine (Construction, application and comparison)
- 3.2 Firing order – Need, Star diagram for inline and V-Engine.
- 3.3 Engine Balancing & Vibration – Various engine foundation (rubber and hydraulic). Various factors affecting engine vibrations (detail)
- 3.4 Fuel filters – Necessity, types - macro, micro, paper, mesh gauge, and sedimentation. (Construction, working & maintenance)
- 3.5 Air Cleaners- Light duty, heavy duty, medium duty, centrifugal, pre chamber, oil bath type heavy duty, Remote mounted air filter, Carburettor mounted or throttle body mounted air cleaner, ring type air filter (Central type), Panel type side mounted, Cyclone type air cleaner. (Construction, application and comparison)
- 3.6 Failures, symptoms and remedies in Air cleaner preventive maintenance
- 3.7 Assignment: Study of Air cleaner available for various types of vehicle.

4.0 ENGINE LUBRICATION **4**

- 4.1 Introduction of Lubrication system of engines
- 4.2 Meaning of friction
- 4.3 Mechanism of Lubrication
- 4.4 Functions of Lubricating Oil
- 4.5 Viscosity
- 4.6 Properties of Lubricating oil
- 4.7 Additives for Lubricants
- 4.8 Importance of Low Viscosity oil
- 4.9 Classification of Lubricating oil
- 4.10 Lubrication system in automobile engines
- 4.11 Crankcase ventilation
- 4.12 Lubrication Chart

5.0 ENGINE COOLING **5**

- 5.1 Need & kinds of engine cooling
- 5.2 Air Cooling – (Construction, working, advantages and limitations)
- 5.3 Water-cooling system – Sub systems - Thermo-siphon, Pump circulation, cooling with thermostatic regulation, pressurized water-cooling and evaporative cooling
- 5.4 Cooling System operation– Normal flow cooling system and reverse flow cooling. (Working, Circuit diagram & comparison)
- 5.5 Parts of Cooling system– Water-jackets in cylinder head and block, hoses joints, water pump, thermostat (Type, Construction & working), Cooling Fan and Fan Belts, Radiator (Tubular and Cellular Type), Radiator Cap Coolant – (Types, Composition, Properties)
- 5.6 Cooling water additives

6.0 ENGINE TESTING **6**

- 6.1 Classification of tests

- 6.2 Engine performance Parameters to be tested viz. IHP, BHP, efficiency, fuel consumption, air consumption, lubricating oil consumption)
- 6.3 Variables involved (Engine speed, air fuel ratio, throttle opening, spark timing, temperature of coolant, exhaust gases)
- 6.4 Measurement of indicated power
- 6.5 Measurements of brake horsepower – Friction dynamometer, hydraulic dynamometer, electrical dynamometer (swing field and Eddy current)
- 6.6 Mechanical efficiency (Morse test)
- 6.7 Measurement of fuel consumption, SFC
- 6.8 Thermal efficiency
- 6.9 Relative efficiency
- 6.10 Air consumption measurement i.e. volumetric efficiency
- 6.11 Measurement of engine oil consumption
- 6.12 Heat balance

SUGGESTED LIST OF LAB EXPERIMENTS

45

Dismantle and Assembly of petrol engine (two wheeler) like scooter, motorcycle etc.

1. Dismantle and Assembly of petrol engine (four wheeler).
2. Dismantle and Assembly of diesel engine (four wheeler).
3. Remove the cylinder head, identify different types of pistons and piston faults.
4. Dismantle of engine, identify and check the following components – cylinder block, crankshaft, connecting rod, inlet and exhaust manifolds, valve train and its components,
5. Demonstration of lubricants chart.
6. Remove the radiator from the vehicle, check it for leak, clean and reverse flush the radiator and refit
7. Remove the water pump, clean, inspect and refit
8. Remove the thermostatic valve, check and refit
9. Engine performance testing on testing bed. (Petrol & Diesel Engine)

REFERENCE BOOKS:

1. Kirpalsingh *Automotive Engineering Vol I* Standard publishers and distributors, New Delhi
2. Crouse & Anglin *Automotive Mechanics* McGraw Hills International Pub
3. K. K. Jain & R. B. Asthana *Automobile Engineering* TMH
4. Don Knowles *Auto Mechanics- Understanding new technology* Reston Publishers, New Jersey
5. Mathur & Sharma *Internal Combustion Engine* Dhanpat Rai & Sons, New Delhi
6. Bosch *Diesel Fuel Injection* SAE (distributor)
7. Anthony E. Schwaller *Motor Automotive Technology* Delmar Publishers, USA

WORKSHOP PRACTICE-III

L T P
0 1 4

Curri. Ref. No. AE 410

Total Contact hrs.: 75

Total marks: 100

Theory:

Tutorial :15

End Term Exam:

Practical : 60

P.A.:

Credit: 3

Practical:

End Term Exam: 50

P.A.: 50

RATIONALE:

Manufacturing of products is done through use of various machineries and processes in industry. It is therefore, essential for automobile engineers have on hand practical training in there manufacturing processes and operation of the machineries.

UNIT TOPIC / SUB-TOPIC	Periods
1.0 ADVANCED MACHINERY PRACTICE	10
1.1 Job practice involving	
1.1.1 Drilling	
1.1.2 Boring	
1.1.3 Internal V-thread cutting	
2.0 MACHINE SHOP	15
2.1 Making a V-block in shaping machine	
2.2 Machining horizontal and vertical surface on planning machines	
2.3 Making a key way on slotting machine	
2.4 Different types of surfacing and gear cutting on milling machines	
3.0 FOUNDRY PRACTICE	20
3.1 Use of foundry tools and equipments.	
3.2 Preparation of molding sand.	
3.3 Making of simple moulds.	
3.4 Making Cores using different types of patterns.	
3.5 Study of cupola and tilting furnace.	
3.6 One job on Ferrous/Non-ferrous casting.	
4.0 ADVANCED WELDING PRACTICE	15
Practice on MIG/TIG welding (Joining two non-ferrous parts)	
5.0 JOB INVOLVING WORK ON CNC LATHE	15

REFERENCE BOOKS:

1. S.K. Hajra Choudhury *Workshop Technology Vol 1 & 2* Media Promoters of Publishers
2. Khanna, O.P. *Workshop Technology* Dhanpat Rai & Sons Publications
3. Chapman *Workshop Technology Parts 1 & 2* 4th Edition, Viva Books P. Ltd., New Delhi
4. Kenyon Pitman *Basic Fabrication & Welding* Pitman Pub. Ltd.
5. P.N.Rao *Manufacturing Technology* Tata Macgraw Hill

AUTOMOBILE CHASSIS

L T P
3 0 3

Curri. Ref. No. AE 411

Total Contact hrs.: 90

Total marks: 150

Theory:

Theory: 45

End Term Exam: 75

Practical : 45

P.A.: 25

Credit: 5

Practical:

End Term Exam: 50

P.A.: 50

RATIONALE:

Motor vehicle consists of chassis frame & body to which various systems viz. engine, transmission, steering, suspension, brakes, etc. are located. The proper & co-ordinated functioning of all such systems ensures efficient, comfortable & safe operation of motor vehicle. Automobile Engineer must know thoroughly principle, construction, working of all these systems. This will help him to work effectively in the areas of manufacturing, operation and maintenance of automobiles.

UNIT TOPIC / SUB-TOPIC	Periods
1.0 CHASSIS LAYOUT	4
1.1 Classification of chassis	
1.2 Types of frames and sub- frames	
1.3 Four wheeler- chassis layouts & types	
Front Engine Front Wheel Drive Vehicle (FE FWD)	
Rear Engine Rear Wheel Drive Vehicle (RE RWD)	
Front Engine Rear Wheel Drive Vehicle (FE RWD)	
Four Wheel Drive Vehicle (FWD)	
1.4 Two Wheelers- chassis types for motor cycle	
2.0 WHEELS & TYRES	4
2.1 Wheel -Requirement of wheel, Wheel Dimensions	
2.2 Disc Wheel: - Light alloy wheel, forged wheel (Construction, comparison and application), inset, zero set, out set, reversible, divided wheel, two piece wheel, three piece wheel	
2.3 Wire wheel: - Arrangement of wires for load in various directions, comparison with light alloy wheel	
2.4 Tyres - Desirable properties and consideration in tyre design. Tyres:- size, designation, speed limitation and aspect ratio, General cross-section of tyre	
2.5 Conventional tube tyre and tubeless tyre (Construction and comparison), Cross ply, radial ply and belted bias type (Construction and comparison)- relative advantages & disadvantages, tyre trouble shooting	
3.0 BEARING, SEALS AND LUBRICATION	3
3.1 Bearing - Different types and specifications of bearings used in chassis, Method of fitment and safety	
3.2 Seals- Different types and specifications of seals used in chassis, method of fitment and safety	

3.3 Lubricants- Different lubricants used in chassis and SAE index

4.0 STEERING

5

- 4.1 Different types of front axle (layout only)
- 4.2 Detail construction of front axle & wheel mounting (RWD vehicle).
- 4.3 Legal requirement of steering system.
- 4.4 True rolling of wheels.
- 4.5 Steering as controlling system.
- 4.6 Turning radius requirement of perfect steering.
- 4.7 Factors of wheel alignment -Toe in, Toe out, camber, caster, kingpin inclination / steering axis inclination, combined angle and scrub radius (Objective, magnitude, drawing, effect)
- 4.8 Types of Steering Gears: - Worm and wheel, cam and double roller, worm and nut, reciprocating ball type, rack and pinion. (Construction, working, application, comparison and backlash adjustment)
- 4.9 Steering Columns: - Construction of a steering column, Special steering column-Collapsible, energy absorbing, tilting wheel, telescopic, tilt and telescopic, steering column with anti theft lock
- 4.10 Power Steering- need and brief description
- 4.11 Steering trouble shooting

5.0 SUSPENSION

5

- 5.1 Requirement of suspension, classification of suspension system, various positions of springs in automobile suspension
- 5.2 Rigid Axle Suspension Leaf spring suspension (tyres, construction & working)
- 5.3 Independent Suspension system for front wheel_Wishbone, Macpherson_sturt vertical guide, trailing link, swinging half axle, lateral and transverse links. (working, layout, application) Independent Suspension system for Rear wheel – De Dion axle, Trailing link & Semi trailing arms (working, layout, application)
- 5.4 Links used in suspension system - Stabilizer bar, anti-roll bar, Panhard rod, trailing arms, transverse link, Watts linkage, A arms, lateral link & semi trailing arms (Function, Location)
- 5.5 Dampers - Single tube type, telescopic type (Necessity, Construction, working and damping characteristics)
- 5.6 Fault symptoms, causes, and remedies in suspension system

6.0 TRANSAXLE & REAR AXLE OF F.W.D. VEHICLE

5

- 6.1 Arrangement and layout, constructional details, components /subassembly of transaxle i.e. wheel bearing and hub assembly, steering knuckle with pressed in bearing and two separate tapered roller bearing
- 6.2 Front drive axle with C.V. joint, types of drive axles.
- 6.3 Rear axle arrangement of front wheel drive vehicle with independent suspension system and semi-independent suspension system i.e. McPherson, Semi independent. (Layout and construction)

7.0 BRAKES

5

- 7.1 Legitimate requirements of brakes - Brake efficiency, extent of deceleration and stopping distance

- 7.2 Weight Transfer – Forces on vehicle moving down an incline, Brakes applied on front wheel only, Brakes applied on rear wheel only, Brakes applied on all the wheels (no proof)
- 7.3 Types of brakes according the Purpose, Location, Construction, Method of actuation (mechanical, hydraulic, air), Extra braking effort (servo)
- 7.4 Types – Drum brakes (Construction, working) – Fixed expander type, floating expander type, floating anchor type, two leading shoe type, two trailing shoe type
- 7.5 Disk brake construction, working and comparison with drum brakes
- 7.6 Hydraulic Brakes (Layout & Construction)
- 7.7 Vacuum Servo brakes (Layout & Construction)
- 7.8 Pneumatic brakes (Layout & Construction)
- 7.9 Faults in brakes - Fading of brakes, Wheel Skidding, Pulling on one side, spongy bakes, leakage etc. remedies

8.0 PASSENGER SAFETY FETUTRES

3

- 8.1 Introduction
- 8.2 Airbag
- 8.3 ABS
- 8.4 TCS
- 8.5 Other intelligent safety systems

SUGGESTED LIST OF LAB EXPERIMENTS

45

1. Draw various vehicle chassis layout for two wheelers
2. Draw various vehicle chassis layout for four wheelers
3. Study centrifugal clutch of two wheelers .Observe the arrangement and sketch the system
4. Study multiplate clutch used in two wheelers ,observe the driving linkages and sketch the system.
5. Study disc wheel and wire wheel
6. Study conventional tube tyre and tubeless tyre
7. Study transaxle and rear axle of F.W.D Vehicle
8. Study the steering linkage and sketch
9. Study the differential ,sketch the unit with bearing location
10. Study front axle as well as rear axle leaf spring and telescopic shock absorber, observe and sketch
11. Study drum and disk brakes, identify the components and compare to each other
12. Study different types of safety feature of passenger vehicles

REFERENCE BOOKS & LEARNING RESOURCES:

1. Kirpalsingh *Automotive Engineering Vol I* Standard publishers and distributors, New Delhi
2. Crouse & Anglin *Automotive Mechanics* McGraw Hills International Pub
3. K. K. Jain & R. B. Asthana *Automobile Engineering* TMH
4. Don Knowles *Auto Mechanics- Understanding new technology* Reston Publishers, New Jersey
5. Mathur & Sharma *Internal Combustion Engine* Dhanpat Rai & Sons, New Delhi
6. Bosch *Diesel Fuel Injection* SAE (distributor)
7. Anthony E. Schwaller *Motor Automotive Technology* Delmar Publishers, USA
8. T. W. Birch *Automotive Chassis System* Delmark Thompson learning Inc. New York
9. Bosch *Automotive Handbook* SAE (distributor)

APPLIED TECHNOLOGY COURSES

AUTOMOTIVE AIR CONDITIONING

L T P
2 1 4

Curri. Ref. No. AE 501

Total Contact hrs.: 105

Total marks: 100

Theory:

Theory: 30

End Term Exam: 50

Tutorial 15

P.A.:

Practical : 60

Practical:

Credit: 5

End Term Exam: 25

P.A.: 25

RATIONALE:

The automotive users want comfortable atmosphere inside the automobiles. The ambient temperatures in winter and summer needs to be controlled by heating or cooling processes of air conditioning, as well as maintenance of fresh and healthy air in side the automobiles. As a automobile person, he/she has to install, maintain or operate such air conditioning systems in automobiles. This subject focuses these needs and addresses the issues of this area.

UNIT TOPIC / SUB-TOPIC	Periods
1.0 INTRODUCTION	8
1.1 Need of ventilation, heating & Air conditioning of cars, multi utility vehicles, vans, safari, heavy passenger vehicle – coaches, cargo vehicle cabin, special application vehicle viz. vehicle used for transportation of perishable commodities & cryogenic substances (general requirements & broad comparison)	
1.2 Ventilation – Needs for various applications under different circumstances	
1.3 Types of ventilation – uncontrolled & controlled ventilation	
1.4 Uncontrolled ventilation – meaning, application & comparison	
1.5 Controlled ventilation – meaning, types, applications & comparison	
1.6 Heating –Needs for various applications under different circumstances	
1.7 Air Conditioning -Needs for various applications under different circumstances	
1.8 Cost of running of HVAC (cars, heavy, passenger vehicles & special application vehicle)	
1.9 Auto sensors	
2.0 HEATING SYSTEM	8
2.1 Layouts for various applications	
2.2 Various components – function, construction, working, maintenance, general faults & their remedies	
2.3 Various positions of heating control knob & relevant mechanism & body respective air flow patterns in car	
2.4 Blower motor electrical circuit & concerned important electrical component	
3.0 AIR CONDITIONING SYSTEM	8
3.1 Manual, semi automatic & Automatic Air conditioning system (Details & comparison)	
3.2 Layouts for various applications	

- 3.3 Various components, their function, construction, working, maintenance and recurring faults & their remedies.
- 3.4 Control panel (Any two varieties - push button & knob type)-Control system for manual Air Conditioning System. Parameters to be controlled. Electro-mechanical circuit-Major components of control circuit & their function
- 3.5 Control System for Semi Automatic Air Conditioning System Parameters to be controlled. Electro-mechanical circuit- Major components of control circuit & their function.
- 3.6 Control System for Automatic Air Conditioning System. Parameters to be controlled. Electro-mechanical circuit- Major components of control circuit & their function
- 3.7 Refrigerant
- 3.8 Popularly used refrigerants & their comparison

4.0 MAINTENANCE & REPAIRS OF AIR CONDITIONING 10

- 4.1 Scheduled maintenance.
- 4.2 Visual & acoustic check
- 4.3 Breakdown maintenance – location cause, symptom & remedies pertaining to following problems-
 - Abnormally high suction pressure
 - Abnormally high delivery pressure
 - Abnormally low suction pressure
 - Abnormally low delivery pressure
 - Gas & oil leakage
 - Improper attraction for magnetic clutch
 - Slip of magnetic clutch
- 4.4 Leakage detection – equipment used, procedure, precaution
- 4.5 Discharging Refrigeration – equipment used, procedure, and precaution
- 4.6 Charging – equipment used, procedure, precaution

5.0 RETROFITTING & ALTERATION IN AUTO AIR CONDITIONING SYSTEM 6

- 5.1 Compatibility of vehicle for retrofitting
- 5.2 Selection of capacity & outlets for Air Conditioning system.
- 5.3 Preparatory work for retrofitting & Air Conditioning System.
- 5.4 Tools, fitting procedure & precautions
- 5.5 Altering existing Air Conditioning C system

6.0 ENVIRONMENTAL ASPECTS RELATED AIR CONDITIONING 5

- 6.1 Ozone Depletion
- 6.2 Green Home Effect
- 6.3 Global Warming
- 6.4 Assignment-Prepare project report repairing & retrofitting Auto A/C system – economics (fixed, running, charger, profit) equipment, consumable & lay-out, Compare the specification of HVAC systems of various categories of vehicles.

SUGGESTED LIST OF LAB EXPERIMENTS

60

1. Study auto air-conditioner, identify different components, inspect and reassemble
2. Visually inspect following components of A/C system and list down their specifications-
 - Evaporator
 - Condenser.
 - Blower
 - Compressor
3. Inspect control system of Automatic Air Conditioner and draw main control circuit and their functions
4. Write down the procedures of the following –
 - A.C. system evacuation
 - A.C. system discharging
 - A.C. gas charging
5. Identify and draw a neat diagram of hoses and couplings used in auto air-conditioning.
6. Perform nitrogen-leak test
7. Identify and use various equipment/tools for A/C Maintenance
8. Write down procedures for retrofitting of auto air conditioner system
9. Compare the specification of HV A/C system of various categories of vehicles
10. Charging and discharging of auto air conditioner

REFERENCE BOOKS:

1. Kirpalsingh *Automotive Engineering Vol I* Standard publishers and distributors, New Delhi
2. Crouse & Anglin *Automotive Mechanics* McGraw Hills International Pub.
3. K. K. Jain & R. B. Asthana *Automobile Engineering* TMH
4. Don Knowles *Auto Mechanics- Understanding new technology* Reston Publishers, New Jersey.
5. Mathur & Sharma *Internal Combustion Engine* Dhanpat Rai & Sons, New Delhi.
6. Bosch *Diesel Fuel Injection* SAE (distributor)
7. Anthony E. Schwaller *Motor Automotive Technology* Delmar Publishers, USA.
8. T. W. Birch *Automotive Chassis System* Delmark Thompson learning Inc. New York
9. Bosch *Automotive Handbook* SAE (distributor)

VEHICLE MAINTENANCE & GARAGE PRACTICE

L T P
3 1 2

Curri. Ref. No. AE 502

Total Contact hrs.: 90

Total marks: 100

Theory:

Theory: 45

End Term Exam: 50

Tutorial: 15

P.A.:

Practical : 30

Practical:

Credit: 5

End Term Exam: 25

P.A.: 25

RATIONALE:

Automotive sector is growing at a very fast rate in our country. The growing population of automotive users demand efficient and effective services for repair and maintenance of vehicles. The repair and maintenance of automotive vehicles needs a variety of resources like, tools, equipment, machines as well as the right people with necessary attitudes and management abilities. This subject deals with these areas of resources for automotive sector so that the supervisors are well informed and equipped for repairs and maintenance works.

UNIT TOPIC / SUB-TOPIC	Periods
1.0 RELEVANT WORK PROFILES	5
1.1 Final vehicle assembly supervisor	
1.2 Engine assembly supervisor	
1.3 Vehicle Testing supervisor	
1.4 Rectification supervisor	
1.5 Authorised service station supervisor	
1.6 Small to medium garage owner	
1.7 Service engineer of a automobile company	
1.8 State transport workshop maintenance supervisor	
2.0 BEHAVIOURAL SKILLS & ATTITUDES	5
2.1 Behavioural skills and attitudes necessary for garage practice in various work areas	
2.2 Shop floor communication, Interpersonal skills	
2.3 Application of principles of management & organization in garage practice with suitable examples	
3.0 GARAGE LAYOUT AND MANAGEMENT	10
3.1 Types and layout of garages and service stations	
3.2 Hierarchy Of Service Station - Filling station, Service station, Garages, Garage & motor, Specialised stations (Services extended and general layout)	
3.3 Assignment: Ratings of various service stations based on above-mentioned parameters	
3.4 MIS: Need, Outline – input – output	
4.0 GARAGE EQUIPMENTS I	10
Types, specifications, block diagram, working , price & cost of working of	
4.1 Wheel balancing machine	

- 4.2 Wheel alignment machine
- 4.3 Tyre changing machine
- 4.4 Engine tuning machine
- 4.5 Carbon cleaning machine
- 4.6 Compressors

5.0 GARAGE EQUIPMENT II

8

Types, specifications, block diagram, working , price & cost of working of-

- 5.1 PUC Diesel
- 5.2 PUC Petrol
- 5.3 Battery charger
- 5.4 Car washing machine
- 5.5 Electric Ramp
- 5.6 Hydraulic Ramp
- 5.7 See Saw Ramp
- 5.8 Ramp for 2-wheelers
- 5.9 A. C. charger
- 5.10 A. C. leakage tester
- 5.11 Brake tester
- 5.12 Timing light (stroboscope)
- 5.13 Pneumatic Grease Gun
- 5.14 Garage Cranes
- 5.16 Hydraulic Jack, Floor Jack
- 5.17 Compression setting

6.0 GARAGE TOOLS - GENERAL & SPECIAL

6

Use, specification, cost awareness, drawing not required

- 6.1 Wrenches (Fix, box, Torque, ring, tube)
- 6.2 Screw drivers (fillip, flat, four, way)
- 6.3 Allen keys
- 6.4 Hammer & mallets
- 6.5 Pullers
- 6.6 Engine related tools
- 6.7 Battery related tools
- 6.8 Other transmission tools
- 6.9 Various gauges (bore gauge, Micrometers, vernier, slip gauge, filler gauge)

7.0 GARAGE MACHINES

8

Machine specifications, setting & machining procedure & costing of

- 7.1 Crankshaft Grinding
- 7.2 Crankshaft balancing
- 7.3 Crank case boring
- 7.4 Cylinder boring
- 7.5 Cylinder block facing
- 7.6 Cylinder block honing
- 7.7 Connecting rod straightening
- 7.8 Connecting rod grinding
- 7.9 Valve seat lapping
- 7.10 Valve grinding
- 7.11 Press (Types, specifications, setting & application)

8.0 VEHICLE MAINTENANCE

10

- 8.1 General Machinery Maintenance & Vehicle Maintenance (Comparison)
- 8.2 Vehicle maintenance – Scheduled maintenance and breakdown maintenance
- 8.3 Scheduled Maintenance – Pre-delivery inspection, free services from manufacturer. (Need, Procedure, systems maintained and their schedule)
- 8.4 Warranty Services (Meaning, necessity and authorization)
- 8.5 Warranty claims (Meaning, necessity, authorization and role of company service engineer)
- 8.6 After Warranty services (Schedule – km. or time, Systems maintenance)
Breakdown maintenance (Meaning & examples)

SUGGESTED LIST OF LAB EXPERIMENTS / FIELD VISITS

30

1. Visit to authorized service stations of latest vehicle manufacturer like – Maruti, Hundai, Tata Motors etc.
2. To wash and serving the car using power washing machine.
3. Identify and draw various special tools used in engine maintenance and repairs
4. Identify and handle various gauges used in auto workshop
5. Set and operate torque wrench
6. Use and draw various bearing pullers used in garages
7. Visit to various maintenance/serving stations to study maintenance schedule
8. Set and use various garage machines such as
 - Crank shaft grinding machine
 - Crank case boring machine
 - Cylinder boring machine
9. Check and correct front wheel alignment
10. Check and correct wheel balancing

REFERENCE BOOKS:

1. K.K. Jain & R. B. Asthana *Automobile Engineering* TMH
2. John Queenborough *Garage and service station handbook* George newness Ltd, London
3. A. W. Judge *Motor vehicle engine servicing* Pitman Paperback, UK
4. Marshall *Car repair and maintenance* Cavendish Ltd, London

TRANSPORT MANAGEMENT & MOTOR VEHICLE ACT

L T P
3 0 0

Curri. Ref. No. AE 503

Total Contact hrs.: 45

Total marks: 100

Theory:

Theory: 45

End Term Exam: 75

Practical : 0

P.A.: 25

Credit: 3

Practical:

End Term Exam:

P.A.:

RATIONALE:

Use of motor vehicle & their operations is regulated by motor vehicle act 1989 in India. Motor vehicle is used as a means of transport on road. With the enhanced mobility of passengers & freight from one corner of country to the other, this sector has phenomenal growth.

As automobile engineer is involved in various aspects relate motor vehicle he should know various acts related to motor vehicle, transport etc.

UNIT TOPIC / SUB-TOPIC	Periods
1.0 WORK PROFILES	3
1.1 Assistant inspector of motor vehicle	
1.2 Insurance surveyor	
1.3 State transport Depot manager	
1.4 Fleet scheduling supervisor	
2.0 MOTOR VEHICLE ACT 1989	10
2.1 Need for Motor Vehicle act	
2.2 Organization of motor vehicle department at National & State Level	
2.3 Licensing (procedure, conditions, and forms)	
2.4 Two wheeler (Moped, Motor cycle), Four Wheeler (Light Motor Vehicle, Light Motor Vehicle Transport, Heavy, Passenger) and Special Vehicles viz Tractor, Forklift etc.	
2.5 Driving school license Procedure, Requirements and Curriculum	
2.6 Vehicular pollution centre- Petrol & Diesel license Procedure, Requirement	
2.7 Conductors license (Eligibility & procedure)	
2.8 Registration of motor vehicle- Necessity and types	
2.9 Temporary registration- Need and procedure	
2.10 Registration Need and procedure for various classes of vehicles	
2.11 Transfer of ownership and alteration in vehicle – procedure	
2.12 Submission for ensuring fitness – need, conditions certificate of fitness- validity	
2.13 Suspension and cancellation of registration	
3.0 CARRIAGE PERMIT	5
3.1 Need	
3.2 Validity	
3.3 Types of carriage permits- stage and contract	

3.4	Stage carriage permits - Definition and types	
3.5	Procedure	
3.6	Requirements	
3.7	Transfer & cancellation	
3.8	Conditions in different types of Stage carriage of permits	
3.9	Contract carriage permits - Definition and types	
3.10	Procedure	
3.11	Requirements	
3.12	Transfer & cancellation	
3.13	Conditions in different types of contract carriage of permits	
3.14	Assignment: Case study (Carriage of dangerous goods)	
4.0	TAXATION	3
4.1	Need	
4.2	Two-wheeler (method & amount)	
4.3	Four-wheeler ((method & amount)	
4.4	Passenger tax ((method & amount)	
4.5	Goods tax (method & amount)	
4.6	Tax exemption (method & condition)	
5.0	MOTOR VEHICLE INSURANCE:	5
5.1	Introduction and classification of insurance.	
5.2	Insurance regulatory authority in India. (Role and jurisdiction)	
5.3	Motor Vehicle Insurance	
	<ul style="list-style-type: none"> • Comprehensive (meaning, types, various provisions, condition, premium calculation, bonus, risk cover) • Third Party (meaning, types, various provisions, condition, premium calculation, bonus, risk cover) 	
5.4	Accident claims settlement – Procedure.	
5.5	Liability without fault in certain cases.	
5.6	Claims tribunal (need, members & work)	
6.0	TRANSPORTATION	4
6.1	Meaning & nature of transport	
6.2	Elements of transport - Tracks or routes, Unit of conveyance or vehicle, Motive power, Terminals, Cost & time, Cargo, Technology	
6.3	Classification & comparison of transport model – Road, Railway, Water, Airways, Pipelines	
7.0	TRANSPORT WORKERS ACT – 1961	5
7.1	Provisions of the act- Uniforms, Duty hours, Minimum wages, Leave, Provision for health & welfare of employee	
7.2	Accidents - Define Road accidents, Causes of Road accidents, Investigation procedure in State Transport units, Compensation as per MV Act 1988, Classification of accidents, Measures for accidents prevention	

8.0 SAFETY OF MOTOR VEHICLES **5**

- 8.1 General
- 8.2 Lamps, brakes, horns, silencers, mirror, noise, dangerous projections, safety glass
- 8.3 Movement forward & backward, emission of smoke & smoke meters, grease & vapour, overhang, limit of carrying capacity, body dimensions, guard rails, life guards, compulsory electric lighting fire extinguishers, spare wheels & tools
- 8.4 First aid box, testing & inspection of private service vehicles, fitment of reflectors

9.0 CONTROL OF TRAFFIC **5**

- 9.1 Signaling devices
- 9.2 Installation & use of weighing devices
- 9.3 Towing
- 9.4 Footpaths
- 9.5 Cycle tracks and traffic segregation
- 9.6 Projection of loads
- 9.7 Restriction as to carriage of dangerous substances
- 9.8 Use of lamps when vehicle at rest, stop sign on road surface
- 9.9 Traffic sign to be observed

SUGGESTED INDUSTRY OR FIELD VISITS

1. Visit to Road transport office
2. Visit of accident site/ garage during survey
3. Visit to local driving school.
4. Visit to state transport depot

REFERENCE BOOKS & SUGGESTED LEARNING RESOURCES

1. The Chartered Insurance Institute Tuition Service *Auto Insurance*
2. Bill Tobolt *Auto body repairing and repairing* The Good Heart- Willcox Co. Inc, Home wood, Illinois
3. Verma and Agarwal *Insurance* Forward Book Depot Nai Sarak, Delhi
4. *Elements of General Insurance* LIC Publications
5. *Motor vehicle act, 1988* Eastern Book company, Lukhnow.
6. *Overdrive* Tata Infomedia ltd, Mumbai
7. *Automotive engineering* Society Of Automotive Engineering, (SAE)
8. *Insurance Times* The institute of insurance surveyors and adjusters 25, Baranashi Ghosh Street, Calcutta, India
9. *Service manuals of various auto manufacturer* Respective manufacturer
10. *Auto manufactures' parts catalogues* From various auto manufactures

AUTOMOBILE WORKSHOP

L T P
0 1 4

Curri. Ref. No. AE 504

Total Contact hrs.: 75

Total marks: 100

Theory:

Theory: 0

End Term Exam: 0

Tutorial: 15

P.A.: 0

Practical : 60

Practical:

Credit: 3

End Term Exam: 50

P.A.: 50

RATIONALE:

Automobile students should have a practical knowledge and skill about the use of tools and instruments necessary for testing, repairing and the maintenance of automobiles, which is the purpose of this laboratory course.

UNIT TOPIC / SUB-TOPIC	Periods
PART A	35
1.0 Study of different types of automobile hand tools and equipments	
2.0 Dismantling of petrol & diesel engines and assembling the same	
3 a) Gasket cutting of different engine parts	
b) Engine bearing setting and measuring	
c) Connecting rod alignment	
d) Valve clearance adjustment, valve timing adjustment	
e) Cleaning of exhaust pipe silencer	
f) Setting of piston ring gap and installation of rings on piston.	
g) Water pump servicing, radiator servicing and adjustment of fan belt tension	
h) Servicing of fuel supply systems including cleaning of petrol and diesel tank, servicing of petrol pump, servicing of carburetor, air cleaner.	
i) Servicing of oil pump filter, clearing of oil gallery and checking of engine oil	
4 Testing and servicing of diesel fuel pump	
5 a) Engine tuning, spark plug cleaning & gap adjustment	
b) C.B. point setting and gap adjustment	
c) Idling speed adjustment & test by smoke	
6 a) Study of ammeter, voltmeter and fare counter meter in taxi and auto rickshaw	
b) Practice in preparing small wiring circuit by using tumbler switch & bulb	
PART B	40
1. Servicing of different kinds of clutch, riveting clutch facing & assembling, clutch pedal adjustment	
2. Servicing of gear box, selector mechanism	
3. Servicing of propeller shaft, universal joint & sliding joint	
4. Servicing of front axle assemblies	

5. Servicing of independent suspension system & absorber
6. Servicing of steering mechanism & wheel alignment
7. Servicing of brakes: re-cycling brake shoe, testing of brake shoe return spring, brake pedal adjustment, servicing of hydraulic brake system, bleeding of brakes
8. Servicing of tyres and tubes. Cold patch and hot patch
9. Washing, cleaning, polishing & spray painting of cars
10. Battery :- specific gravity testing, cell testing, battery charging preventing leakage in battery
11. Self starter :- servicing of starter motor replacement of brushes, bendix drive
12. Ignition system:- ignition coil, condenser, rotor, spark advance mechanism, distributor, setting of C.B. points, testing & cleaning of spark plug & setting gap, setting of ignition timing & firing of magnet ignition system.
14. Adjustment and repair of horns, wind screen wipers, indicators, repairing wiring for ignition & lighting, setting of head lights, arrangement of wiring diagrams of different cars.
15. Pollution testing with the aid of exhaust gas analyser.

REFERENCE BOOKS :

1. Kirpal Singh *Automobile Engineering Vol I, Vol-II* Standard. Publishers
2. Heitner *Automotive mechanics* CBS Publishers.
3. K.K. Jain & R. B. Asthana *Automobile Engineering* Tata McGraw Hills Publication New Delhi

AUTOMOBILE POWER TRAIN

L T P
3 1 2

Curri. Ref. No. AE 505

Total Contact hrs.: 90

Total marks: 150

Theory:

Theory: 45

End Term Exam: 75

Tutorial 15

P.A.: 25

Practical : 30

Practical:

Credit: 5

End Term Exam: 25

P.A.: 25

RATIONALE:

The power developed by automobile engine is transmitted to the rear axle through many parts & mechanisms such as clutch, gearbox, propeller shaft and differential. The entire system is called power transmission mechanism in automobile. Knowledge of automobile transmission is of vital importance for an automobile engineer.

UNIT TOPIC / SUB-TOPIC	Periods
1.0 CLUTCH	15
1.1 Requirements of clutch	
1.2 Classification of clutch based on various parameters	
1.3 Single Plate dry type clutch (construction, working, and comparisons)	
1.4 Single Plate diaphragm spring type clutch. (Construction, working, and comparisons)	
1.5 Multi plate clutch For Two and Four Wheelers (Construction, working, comparison)	
1.6 Semi centrifugal clutch and Centrifugal Clutch (Construction, working, comparison)	
1.7 Clutch actuating mechanism – Cable & Linkage type.	
1.8 Power assisted clutch - Hydraulically operated clutch, Vacuum assisted clutch. (Circuit diagram, construction and working of master cylinder and slave cylinder.)	
1.9 Fluid Flywheel (Construction, working, characteristics, comparison with friction clutch.)	
1.10 Freewheel clutch (Operation, construction, application)	
1.12 Faults, Symptoms, cause and remedy viz. Clutch slip, clutch drag or spin, clutch rattle, clutch judder, knock, pulsation of clutch pedal	
2.0 GEAR BOX	15
2.1 Function and Necessity	
2.2 Types of Gears & Gear trains, Gear terminology, backlash and its need	
2.3 Sliding Mesh gearbox. (Construction, Working, Limitations and Application)	
2.4 Constant Mesh Gear Box. (Construction, Working, Limitations, Application & Double declutching phenomenon)	
2.5 Synchromesh Gear Box. (Construction, Working, Limitations, Application and Comparison)	
2.6 Epicyclic Gear Box. (Construction, Working, Limitations and Application)	
2.7 Selector Mechanism with steering column mounted & floor mounted (Construction, Working, Limitations and Application. Interlocking Mechanism)	

- 2.8 Overdrive. (Construction, Working, Limitations and Application)
- 2.9 Overdrive engaging & disengaging Mechanism
- 2.10 Transfer Case (Need, types, construction, working and application)
- 2.11 Fault symptoms, causes & remedies viz. Noisy operation during stationary running and moving, Hard Gear shifting, Gear slipping, Oil leakage
- 2.12 Automatic transmission-(Torque converter & planetary gears)-construction, working, maintenance & fault diagnosis

3.0 PROPELLER SHAFT AND UNIVERSAL JOINT 15

- 3.1 Propeller shaft – construction, working, need of center bearing
- 3.2 Hotchkiss drive and torque tube drive – layout, comparison & application
- 3.3 Universal joint- Hooks’ joint, constant velocity joint – types, construction, working and application.
- 3.4 Differential – need, construction and working
- 3.5 Crown and pinion –Various types, comparison and applications
- 3.6 Differential housing- banjo and split type (construction and comparison)
- 3.7 Rear axle- types, construction and comparison
- 3.8 Faults and remedies in drive line and final

4.0 FUNCTION OF A DIFFERENTIAL GEARBOX 8

- 4.1 Types of differential
- 4.2 Constructional details of a differential
- 4.3 Study & inspection of differential

5.0 DEFINITION OF REAL AXLE, SUPPORTING OF REAL-AXLE 7

- 5.1 Rear axle drives such as Hotchkiss drive, torque tube drive etc
- 5.2 Types of rear axle
- 5.3 Rear axle casing

LIST OF PRACTICALS 30

1. Study of Power transmission system of moped
2. Study of Power transmission system of scooter
3. Study of Power transmission system of motor cycle
4. Study of Power transmission system of bullet
5. Study of power system transmission of four wheeler (Petrol Engine)
6. Study of power system transmission of four wheeler (Diesel Engine)

REFERENCE BOOKS:

- 1) Heitner *Automotive Mechanics* CBS Publishers.
- 2) Harbans Singh Reyat *The automobile* S. Chand & Co.
- 3) G.B.S. Narang *Automobile Engineering* Khanna Publishers
- 4) Kirpal Singh *Automobile Engineering Volume-1* Standard Publishers
- 5) W.H. Crouse *Automotive Transmission & Power Train* McGraw Hills
- 6) John Fenton *Handbook of automotive powertrains and chassis design*
Professional Engineering
- 7) Judge.A.W.*Modern Transmission Systems*, Chapman and Hall Ltd., 1990

AUTOMOBILE ELECTRONICS

L T P
3 1 2

Curri. Ref. No. AE 506

Total Contact hrs.: 90

Total marks: 150

Theory:

Theory: 45

End Term Exam: 75

Tutorial 15

P.A.: 25

Practical : 30

Practical:

Credit: 5

End Term Exam: 25

P.A.: 25

RATIONALE:

Auto electrical plays vital role in functioning of various system of motor vehicle. With the advancements in Auto field, electronics has become integral part of controlling system. Further it is assisting various systems to become outmost efficient in their functioning.

Under such circumstances Automobile engineer must thoroughly understand fact, concepts, principles & procedure and able to diagnose the relevant faults and work in auto manufacturing sector.

UNIT TOPIC / SUB-TOPIC	Periods
1.0 INTRODUCTION	8
1.1 Automotive electrical systems- Starting & ignition systems, battery charging systems, lights & horn systems, dash board gauges & indicators and accessory systems	
1.2 Basics of Electrical & Electronics. Earthed return system. Relevant symbols used. Positive & Negative Earthing (comparison)	
1.3 Wiring System - Starting system cable, high-tension cables, General-purpose cables, (requirement, Colour codes used, Sample circuits.)	
1.4 Harnessing method (Figure & advantage). Cable connectors (Types & application) (displays & various layout)	
2.0 BATTERY	8
2.1 Types of batteries- Low maintenance battery, Maintenance free battery (Introduction, construction & Comparison)	
2.2 Lead acid battery (construction & working)	
2.3 Battery Specifications - Battery ratings, Battery voltage & current, Battery performance, Battery discharge rate & capacity, Battery efficiency	
2.4 Battery Testing & Maintenance- Specific gravity test, High discharge test	
2.5 Battery storage and mounting	
2.6 Initial Charging of battery (Procedure)	
2.7 Various symptoms, faults & remedies in battery	
3.0 GENERATOR & ALTERNATOR	8
3.1 Generator - Principle, construction, working, maintenance & limitations	
3.2 Alternator - Advantages over generator, principal, construction, working & testing	
3.3 Alternator circuits with Unit voltage regulator, Two-unit voltage regulator, Regulator with transistor, Fully transistorised regulators,	

Heavy-duty transistor regulator, Alternators with integral regulator. (Circuits, working & advantages)	
3.4 Electrical Testing of Alternator components viz. Rotor, Stator, Rectifier & Regulator	
3.5 Trouble shooting of alternator	
4.0 CRANKING MOTOR	8
4.1 Principle, construction, Working of cranking motor	
4.2 Engaging mechanisms - Bendix drive, Overrunning clutch with & without gear reduction & Dyre drive. (Working, construction, applications & comparison)	
4.3 Testing of cranking motor- Engagement mechanism testing, Performance tests & Insulation tests	
4.4 Trouble shoots cranking system	
5.0 IGNITION SYSTEMS	10
5.1 Requirement of ignition systems	
5.2 Classification of ignition system – Magneto, Battery, Electronic	
5.3 Components of Ignition system - Ignition coil, condenser, Distributor – With magnetic pick up, With contact breaker points, transistorized, With contact points & transistorized amplifier ignition coil, Spark advance mechanisms – Centrifugal advance, Vacuum advance, Fully vacuum advance	
5.4 Magneto Ignition system - Stator, rotor, Circuit diagram, Construction, Principle & Working, and Types of magneto	
5.5 Battery Ignition Circuit diagram, Breaker triggered ignition system, SCR Triggered ignition system, CDI ignition system and Breaker less ignition system	
5.6 Trouble shoots of Ignition system	
6.0 BASIC ELECTRICAL ACCESSORIES	10
6.1 Horns: Wind type Horn, Relay type Horn, Double Horn (Need, construction, electrical circuit, working)	
6.2 Indicating & warning devices (Circuit diagram & working)	
• Fuel Gauge - coil type & thermostatic type (Need, construction & working)	
• Oil pressure gauge - balancing coil type (Need, construction & working)	
• Water temperature gauge- Balancing coil type, Thermostatic type (Need, construction & working)	
• Speedometer- Mechanical type, Thermostatic type (Need, construction & working)	
• Oil pressure warning light (Need, construction & working)	
• Water temperature warning light (Need, construction & working)	
• Choke out warning (Need, construction & working)	
• Brake warning light (Need, construction & working)	
• Ignition warning light (Need, construction & working)	
• Direction indicator with & without flashing (Need, construction & working)	
6.3 Various types of Lamps:-	

- Head lights- Lamps & Sealed beams (Construction, working, specification.)
- Control of headlight beam, headlight dagggle, Ant dagggle devices, Two-filament headlight
- Adjusting headlights, Checking light output.
- Fog lamps – Construction
- Side & Tail lights – (Types, construction & circuit)
- Autronic eye – (Necessity, construction & circuit)
- Parking light - (Necessity, wattages)
- Reversing lamps (Necessity, wattages)
- Interior lighting – (Need & circuit)

7.0 MISCELLANEOUS ELECTRICAL & ELECTRONICS EQUIPMENT & ACCESSORIES **8**

- 7.1 Windshield wiper - flexible cable, chain & gear reduction, mechanism, wiper motor with thermal overload trip & parking switch (Specification, construction, wiring diagram)
- 7.2 Windshield washer (Construction, electrical circuit & working)
- 7.3 Electric fuel pump (Construction, electrical circuit & working)

SUGGESTED LIST OF LAB EXPERIMENTS **30**

1. Testing and servicing of Cranking Motor
2. Study of cranking motor
3. Conduct alternator output test
4. Study of alternator
5. Study of generator
6. Study of Ignition system (Battery Ignition, magnetic ignition, electronic ignition)
7. Study of wiring diagram
8. Study of lighting system
9. Study of electrical fuel pump
10. Study of lead acid battery
11. Specific gravity test
12. Adjustment of ignition timing for multi cylinder engine
13. Testing of magneto ignition system of two-wheeler
14. Testing of various tools & equipment used in testing of Auto electrical system.

REFERENCE BOOKS:

1. Kirpalsingh *Automotive Engineering Vol II* Standard publishers and distributors, New Delhi
2. K.K. Jain & R. B. Asthana *Automobile Engineering* Tata McGraw Hills Publication New Delhi
3. Crouse & Angline *Automotive Mechanics* McGraw Hills International Pub.
4. Young & Griffiths *Automobile Electrical Electronic Equipment* Butter Worth & company Ltd. London
5. P. L. Kohli *Automotive Electrical Equipment* Tata McGraw Hills Publication New Delhi
6. Stackpoole, Morrison & Gregory *Electronics for Motor Mechanic* Longman Cheshire Melbourne, Australia
7. Crouse *Automotive Electric Equipment* McGraw Hills.

AUTO ENGINE RECONDITIONING

L *T* *P*
2 1 4

Curri. Ref. No. AE 507

Total Contact hrs.: 105

Total marks: 100

Theory:

Theory: 30

End Term Exam: 50

Tutorial 15

P.A.: 0

Practical : 60

Practical:

Credit: 5

End Term Exam: 25

P.A.: 25

RATIONALE:

Engine is the heart of the motor vehicle. Its well-being results into efficient, effective, economical and reliable running of vehicle. Such vital system needs timely partial or total overhaul during lifetime of vehicle. Auto Engineer is supposed to supervise such work, therefore, he must be equipped with relevant knowledge, skills and attitudes.

UNIT TOPIC / SUB-TOPIC	Periods
1.0 GENERAL CONSIDERATIONS FOR ENGINE RECONDITIONING	4
1.1 Running in period	
1.2 Engine Life stages	
1.3 Causes of engine breakdown	
1.4 Normal working period	
1.5 Reconditioning period	
2.0 AUTO ENGINE RECONDITIONING	10
2.1 Introduction	
2.2 Need	
2.3 Number reconditioning possible and the life of reconditioned engine.	
2.4 Running of reconditioned engines – need of running period, speed, attention, running in compounds	
2.5 Economic viability for reconditioning	
2.6 Various types of engine reconditioning – petrol and diesel engine reconditioning, on chassis, off chassis, top overhaul and complete overhauling	
3.0 TOP OVERHAUL OF ENGINE	5
3.1 Need	
3.2 Decarbonizing the petrol engine – need, procedure, tools, equipment and consumables required, do's and don'ts	
3.3 The valves and valve seatings overhauling – need, procedure, tools, equipment and consumables required, machining operations, dos and don'ts	
4.0 COMPLETE OVERHAULING OF AUTO ENGINE	15
4.1 Need	
4.2 Dismantling (stripping) the engine – on chassis, off chassis, general procedure for engine removal and stripping, tools, equipment, pullers and dos and don'ts	

- 4.3 Cleaning the engine parts – need, tools, equipment, procedure, special procedure for cleaning certain components viz. valve, piston, timing drive
- 4.4 Examination of engine components for structural and functional aspects – visual, comparison with genuine spares using measuring instruments, testing procedures, special examination procedure for certain components viz. cylinder block, cylinder head, crankshaft, piston, camshaft, connecting rod, gear etc.
- 4.5 Reconditioning of cylinder – criteria and conditions to be considered viz. vehicle history regarding performance, compression, oil consumption, cylinder wear in the form of bore taper, out of roundness, ridge, crack in cylinder, recommendation of vehicle manufacturer etc., temporary remedy to worn out cylinder, specified reboring sizes, specified number of rebores.
- 4.6 Piston and rings – criteria and conditions to be considered for acceptance, replacement of piston, fitting of piston rings, rings for worn-out cylinder
- 4.7 Reconditioning of crank shaft – straightening, truing crank shaft journal, crank shaft grinding, building up worn journals – metal spraying, metallising, welding repairs of crank shaft – machines involved – crack detection, crank shaft grinding, metallising, welding, lathe
- 4.8 Engine bearing conditioning – main journal, connecting rod big and small end, camshaft, rocker arms fitting – rocker supports, machining process reaming, boring, processing, straightening, burnishing, honing, machines – line boring machine, CR small end grinding machine, CR straightening machine, hand press, pullers
- 4.9 Camshaft drive – pulley, sprocket, chain, belt, gears, chain/belt tensioners. Inspection and replacement in case of damage
- 4.10 Reconditioning of lubricating system – gear pump, relief valve, filter body and passages
- 4.11 Reconditioning of cooling system – water pump, radiator, thermostat, hoses.
- 4.12 Reconditioning of ignition system

5.0 FUEL SYSTEM RECONDITIONING AND OVERHAULING 5

(Phasing, calibration, reconditioning and overhauling of all system components)

- 5.1 Petrol engine with fuel injection
- 5.2 Diesel fuel injection system

6.0 ENGINE RE-ASSEMBLY AND TESTING 6

- 6.1 Systematic procedure – following manufacturer’s manual
- 6.2 Engine spark/fuel injection timing setting and tune up
- 6.3 Dos and Don’ts in engine assembly
- 6.4 Special procedure and tightening torques
- 6.5 Running reconditioned engine
- 6.6 Tests – electrical, compression and vacuum
- 6.7 Engine faults symptoms and remedies

**SUGGESTED LIST OF LAB XPERIMENTS/DEMONSTRATIONS/
FIELD OR SITE VISITS 60**

- 1. Visit to engine parts reconditioning workshop to observe Crankshaft, Camshaft, Cylinder Head, Cylinder Block repairs
- 2. Visit to fuel calibration system workshop to observe calibration of Fuel Pump
- 3. Overhauling of Ignition system
- 4. Overhauling of Cooling system

5. Overhauling of petrol & diesel engine
6. Collection of data of specification for overhauling of at least one petrol and diesel engine
7. Collection of data of problems in prevalent petrol and diesel engine
8. Prepare at least four case studies related to fault and identification of auto engine reconditioning

SUGGESTED LEARNING RESOURCES
REFERENCE BOOKS/JOURNALS/MANUALS/CODES OF PRACTICES/STANDARDS.

1. Kirpalsingh *Automotive Engineering Vol 1 & II* Standard publishers and distributors, New Delhi
2. K.K. Jain & R. B. Asthana *Automobile Engineering* Tata McGraw Hills Publication New Delhi
3. Crouse & Angline *Automotive Mechanics* McGraw Hills International Pub.
4. Service manuals of various tyre manufacturers
5. Service manuals of various original equipment pertain to tyre

AUTO BODY WORK PRACTICES

L T P
3 1 2

Curri. Ref. No. AE 508

Total Contact hrs.: 90

Total marks: 150

Theory:

Theory: 45

End Term Exam: 75

Tutorial: 15

P.A.: 25

Practical : 30

Practical:

Credit: 5

End Term Exam: 25

P.A.: 25

RATIONALE:

Most of the recent developments in auto field have taken place in the area of safety, security and comfort. Automobile body mainly contributes in all these aspects of modern requirements and developments.

UNIT TOPIC / SUB-TOPIC	Periods
1.0 INTRODUCTION TO AUTO BODY	5
1.1 Role of auto body in safety, comfort and security of vehicle	
1.2 Requirements of safety, comfort and security in different class of vehicle viz. two-wheeler, passenger cars, multi utility vehicles, Heavy Goods vehicles (Luggage and bulk), Heavy passenger vehicles (Mofissil, City and Coaches) etc in the context of their body.	
1.3 Comparison of modern vehicles with their old counter part pertaining to safety, comfort and security in the context of body	
2.0 PERFORMANCE OF VEHICLE	10
2.1 Different resistances that vehicle experience viz. rolling & frictional resistance, Gradient resistance, Air or wind resistance, Eddy, Aerodynamic drag, Aerodynamic lift, Side force, drag coefficient. Reasons for their occurrence, their measurement and their control	
2.2 Engine related parameters - Tractive efforts, Traction, Draw bar pull, Gradability, Stability on slopes & turns, Acceleration their relevance in auto body	
2.3 Importance of these resistances and parameters for various class of vehicles in the context of their body.	
3.0 BODY LAYOUT AND CHASSIS FRAME FOUR VEHICLES	10
3.1 Two- Wheelers- Motorcycle & scooter	
3.2 Cars – Sedan /Limousine /Saloon, Coupe, Convertible, Estate	
3.3 Hatchback, Sports, Sports coupe, Safari, Station wagon	
3.4 LCV - Multi Utility Vehicle, Van	
3.5 HPMV- Micro buses (25 passengers), City busses (55 passengers), Double Decker, Tour buses (long distance coach)	
3.6 HCGV- Truck, Road Train, Tractor Trailer (Articulated vehicle), Heavy haulage truck, Pick up van, Standard van, Chassis cab (Tilting type & conventional details), MCV walk through van	

4.0 BODY CONSTRUCTION I

15

- 4.1 Streamlining -Effect of streamlining, Drag coefficient & associated power requirement, Functions, load, normal, full forward & semi forward
- 4.2 Body Structure- Unitized body, frame construction (Detailed Nomenclature)
- 4.3 Body Dimensions - Internal Dimension viz. Leg room, Head room, boot room, shoulder room (front & rear), Hip room (front & rear), Parameters which determine passenger car drivers seat location, External Dimension viz. Overhang, wheelbase, track length, ground clearance, approach angle, vertical height, vehicle width overall

5.0 BODY CONSTRUCTION II

15

- 5.1 Body Materials- Sheet metal, Aluminium, plastic, wood (Various sections, environmental aspects), Alternative materials (Examples, Application & Processing methods), Automotive windshield and window glass (Material & Optical properties)
- 5.2 Body finishing components - Bumpers (construction, materials & types), Exterior trims, impact strips (brief), rubber Glazing, Door latches (Construction, working), Various types of Sheets, Interior trims, Beadings (Types & filling)
- 5.3 Body Interiors & Upholstery - Dashboard (Ergonomic arrangement), Window (Construction & operating mechanism), Mirror (Types & use), and Upholstery viz. Seats (bucket & lunch back, sofa type)- General constructions, cushioning properties, cushioning materials, Roof, door & floor upholstery (types & fitting)
- 5.4 Comfort & convenience systems viz. Power windows, Power sunroof, Seat adjustment, Central locking (Working, controls)

6.0 BODY SURFACE TREATMENT

5

- 6.1 Requirement of surface treatment in various applications and locations
- 6.2 Corrosion treatment- importance and types viz. chemical, rubber paint, plating etc
- 6.3 Exterior finishing- painting material, preparation of surface for paint, spray
- 6.4 Painting equipment, spraying techniques, paint defects dos and don'ts about painting

SUGGESTED LIST OF EXPERIMENTS/DEMONSTRATIONS/ FIELD OR SITE VISITS

1. Visit to auto body building workshop.
2. Visit to denting and painting works, Identify various denting and painting equipment and their functioning
3. Visit to upholstery works and observe how to built comfort system in any vehicle
4. Draw a body structure of a car & a bus.
5. Compare specifications and features of Auto paints and coats available in the market.
6. Demonstrate the use of body and fender tool kit.
7. Identify and draw a neat diagram of various sections and joints used in bus body building viz. hat, Z, channel, gussets, clits etc.
8. Visit to modern painting booth
9. Study of prevalent auto body decoration and safety components and assembles

**REFERENCE BOOKS /JOURNALS /MANUALS CODES OF PRACTICES /
STANDARDS**

1. Kirpal Singh *Automobile Engineering Vol-I* Standard Publishers New Delhi
2. Bill Tobolt *Auto body repairing and repainting* The Good Heart- Willcox Co. Inc, Home wood, Illinois
3. John Kendrick and Robert Macpherson *Crash Assessment and repairs* Mc Grow Hills Book Company (UK) Ltd., Landon
4. SAE, USA, *SAE Handbook*.
5. Auto body builders' viz. ACGL, Sutlug manual vi.
6. Ministry of surface transport, Govt. of India, *Motor vehicle act 1988* .

PROJECT

L T P
0 0 8

Curri. Ref. No. AE 509

Total Contact hrs.: 120

Total marks: 150

Theory:

Theory: 0

End Term Exam: 0

Practical : 120

P.A.: 0

Credit: 4

Practical:

End Term Exam: 0

P.A.: 150

RATIONALE:

Project work is very important activity for the students, as it helps to develop various mental and social skills. The mental skills could be in the areas of problem formulation, gathering data, analysis and use of information, decision-making and solving problems, etc. The social skills could be in the areas of co-operation, exercising tact, communication, valuing time, labour and materials, etc. The successful completion of project results in greater satisfaction and confidence levels of students. This activity has been included here keeping in view with these benefits to the students. The teacher should facilitate the students in carrying out these activities at various stages of the project, so that the students enjoy and learn by doing.

UNIT TOPIC / SUB-TOPIC	Periods
1.0 LITERATURE SURVEY	10
1.1 History of Automobile	
1.2 Various types of roads and their conditions, Traffic density in India & in the state of Nagaland	
1.3 World Automobile Industry (Four wheeler) - Top 15 Automobile manufacturers in World, Their sales of last five years, Their models, Location of plants & collaboration, Their market (where their vehicles sold)	
1.4 India Automobile Industry two-wheeler (Moped, scooterrate, Scooter. & Motorcycle), Passenger Cars, Multi Utility Vehicles (MUV), Heavy Commercial Vehicle (HCV), Heavy Passenger motor vehicles (HPMV)& Tractors	
1.5 Local Manufacturers of above vehicles, their sales for last 5 years, their models & model wise sales statistics, Location & collaboration, their market, their investment & employee strength	
1.6 Specifications of any two vehicles from each of the following categories. two-wheeler (Moped, scooterrate, Scooter, & Motorcycle), Cars, MUV, HCV, HPMV & Tractors	
1.7 New arrivals & their special features from each of the following categories 2 wheeler (Moped, scooterrate, Scooter, & Motorcycle), Cars, MUV, HCV, HPMV & Tractors	
1.8 Prices analysis of all vehicles available in India	
1.9 Popular short forms used in automobile field	
1.10 Auto future and Auto policy in India	

2.0 AUTO ANCILLARIES INDUSTRIES IN INDIA

10

(Name, Location, collaboration, production process, machines, products range & OEM to Automobile Manufacturer)

- 2.1 Tyre
- 2.2 Batteries
- 2.3 Oil, Fuel and coolants
- 2.4 Fasteners & bearings
- 2.5 Engine components – Pistons, Piston rings, connecting rod, crankshaft, valves, gaskets, liners, pumps etc
- 2.6 Components of Transmission subassemblies viz. Gearbox, clutch, propeller shaft, universal joints, constant velocity joints, differential, Axles etc
- 2.7 Steering components – Steering G.B., Power steering
- 2.8 Brake components – Linear, pneumatic brakes, hydraulic cylinders, calliper brakes, and Antilock brake system
- 2.9 Suspension-Dampers, springs, leaf springs, air suspension, hydra gas suspension
- 2.10 Fuel systems – Fuel Pump, FIP, filters, carburettor, injectors, MPFI system etc
- 2.11 Body Building
- 2.12 Body modification
- 2.13 LPG kit, CNG kit
- 2.14 Electrical components – starting motor, Alternator, cut-outs etc
- 2.15 Auto comfort systems – A.C., Central locking, Power windows, Auto Seat adjustments
- 2.16 Exhaust systems – Mufflers, Catalytic converters
- 2.17 Auto security systems – Rollover protection, antitheft alarm etc
- 2.18 Upholstery

3.0 SPARES

10

Referring catalogue, part number, Price, Equivalent parts. Original equipment manufactures (OEM) Discrimination between original & duplicate parts. (Collect catalogue, any 4 examples of equivalent-parts, discrimination of original & duplicate parts any 4 example, legislation against duplicate parts)

4.0 GARAGE TRAINING

60

Minimum two days of training to be taken in following types of garages

- 4.1 Small Two-wheeler garage
- 4.2 Two-wheeler authorised service station with a dealer point
- 4.3 Small Car/MUV garage
- 4.4 Car/MUV authorised service station with a dealer point
- 4.5 Special garage
- 4.6 Tyre retreading unit
- 4.7 Auto air conditioning unit
- 4.8 A small Auto Electrical works
- 4.9 Authorised Auto Electrical works
- 4.10 LPG/CNG retrofitting centre
- 4.11 Tractor garage

20

5.0 PROJECT REPORT

- 5.1 Garage visit report
- 5.2 Seminar presentation
- 5.3 Case studies

SUGGESTED LIST OF EXPERIMENTS / FIELD VISITS

1. Literature survey exercise using different medias namely Internet, Year books, Reference books, Magazines, Service manuals etc
2. Structured exercises during garage training designed mutually by teacher and related official of garage

DRIVING PRACTICE

L T P
0 1 2

Curri. Ref. No. AE 510

Total Contact hrs.: 45

Total marks: 50

Theory:

Theory: 0

End Term Exam: 0

Tutorial :15

P.A.: 0

Practical : 30

Practical:

Credit: 2

End Term Exam: 0

P.A.: 50

RATIONALE:

An automobile engineer, throughout his working life will be involved with automobiles in one way or another. It is therefore, absolutely essential for an automobile engineer to learn to drive an automobile, at least a light vehicle. This course also gives the students opportunity to learn driving a light vehicle.

UNIT TOPIC / SUB-TOPIC	Periods
DRIVING PRACTICE (Light vehicles)	45
1. Identification of vehicle parts and components	
2. Preliminary knowledge about power production and transmission	
3. Practicing and pressing of clutch, brake and accelerator pedal	
4. Practicing steering control	
5. Practicing gear shifting	
6. Driving of vehicle in an open field	
7. Driving of vehicle in an open field by placing several obstacles on particular route	
8. Driving of vehicle in reverse direction	
9. Forward & backward driving of vehicle on a slope	
10. Driving of vehicle on public road	
11. Driving of vehicle at night on ring road	
12. Driving of vehicle on high way	

TECHNICAL SEMINAR

L T P
0 0 6

Curri. Ref. No. AE 511

Total Contact hrs.: 90

Total marks: 100

Theory:

Theory: 0

End Term Exam: 0

Practical : 90

P.A.: 0

Credit: 3

Practical:

End Term Exam: 0

P.A.: 100(Sessional+Viva)

RATIONALE:

Presentation of any technical seminar is very important activity for a student as it helps to develop communication and expressing ability. The successful presentation of technical seminar results in greater satisfaction and confidence levels of students. This activity has been included here keeping in view with these benefits to the students. The teacher should facilitate the students in carrying out presentation of seminars. At least 3 nos. of technical seminars may be arranged.

UNIT TOPIC / SUB-TOPIC	Periods
Seminar I : History of automobiles	90
Seminar II : Details of any automobile parts	
Seminar III : Recent trends in automobile engineering	

Note : Students will collect information and present technical seminars as assigned to them. On the other hand teachers will evaluate the presentation made by students and provide necessary feedback.

INDUSTRIAL TRAINING

L T P
0 0 0

Curri. Ref. No. 512

Total Contact hrs.: 0

Total marks: 200

Theory:

Theory: 0

End Term Exam: 0

Practical : 0

P.A.: 0

Credit: 10

Practical:

End Term Exam:

P.A.: 200(Sessional+Viva)

RATIONALE:

Industrial Training aims at exposing the students to field practices, size and scale of operation and work culture at practical sites. For this purpose, students at the end of fourth semester are required to be sent for a period of 4 weeks to industry.

Each student is supposed to study the material and technology used at site and prepares a detailed report of the observation of process seen by him/her. These students should be supervised and guided by respective subject teachers. Each teacher may guide a group of four to five students.

The Industrial Training has basically the following three components: -

1. Orientation Programme
2. Training in the Industry
3. Report Writing and
4. Evaluation

Orientation programme:

During the orientation programme complete guidelines will be provided to the students regarding planning, implementation and evaluation of industrial training.

Training in industry:

During the training student will have to maintain a daily dairy to record his observations and experiences in various department/section and on the basis of daily dairy student will prepare and submit the Industrial Training Report. Competent faculty / staff member shall follow-up the students progress regularly. The student should be encouraged to seek & collect relevant forms; brochures; & other print material from the various organization related to training/project.

Report writing:

Daily dairy will form the basis for report writing. The formats for the report preparation will vary depending upon the type of training/project and will be generated by the teacher guide.

Evaluation

Faculty member and an expert from industry/field will evaluate the industrial training work of

the student or a group of students jointly. The basis of evaluation will cover following criteria:

- Nature and extent of technical skills learnt
- Innovative skills/problem solving skills.
- Coordination and integration between theory and practice.
- Planning and decision making skills.
- Organization of work.
- Assemble the component/materials being used in given task.
- Work in group or independently and confidently.
- Submission of report.
- Skills and attitudes necessary in a technician.

Note: To assess the student performance, the teacher will provide general guidance.

Expected outcome

Expected outcome of industrial training is the work done by the student or a group of students during the industrial training. Proper recording of events and work done shall be recorded and assessed in the requisite format. The student shall be assessed on the basis of work done during industrial training and report submitted and also by way of oral/ viva voce examination/presentation after completion of the training.

ELECTIVE COURSES

VEHICLE SURVEYING AND ACCIDENTAL REPAIRS

L T P
3 0 2

Curri. Ref. No. AE 601

Total Contact hrs.: 75

Total marks: 150

Theory:

Theory: 45

End Term Exam: 75

Practical : 30

P.A.: 25

Credit: 5

Practical:

End Term Exam: 25

P.A.: 25

RATIONALE:

Estimating, costing, vehicle survey & accidental repairs of automobiles are the important areas towards which least attention is normally paid in the curriculum. The students become aware of this field, only when they work in the workshops. Therefore this area remained unnoticed in polytechnic education. For customer quick service and satisfaction, as a supervisor, he/she should have the necessary information about vehicle survey, estimating and accidental repairs.

UNIT TOPIC / SUB-TOPIC	Periods
1.0 VEHICLE SURVEY	10
<ul style="list-style-type: none"> 1.1 Accidental vehicle Survey-Need 1.2 Dynamics of vehicle accident-lines of force (Direction of travelling tour), Laws of motion, momentum reversing, debris, and Centre of Gravity Rotational forces 1.3 Theory of collapsing metal- primary & secondary impact, Direction of damage (line of impact) 1.4 Characteristics of vehicle damage 1.5 Classification of damage primary and secondary damage, pressure and tension 1.6 Geometry of sheet metal panels and effect of various accidents over them 1.7 Indirect damage – Dent (gongs), Buckles, work hardening, types of buckles- simple ring, Collapsed ring, simple rolled, collapse rolled 1.8 Body opening damages 1.9 Frame damage- for various type body construction 1.10 Misaligned assemblies 1.11 Paint damages 1.12 Old vehicle survey- Need and procedure. Residual life, Reconditioning cost, future maintenance cost, availability of spares in market 	
2.0 VEHICLE ESTIMATION & COSTING	7
<ul style="list-style-type: none"> 2.1 Need 2.2 Types of estimates, their outcomes and clients- The courtesy estimate, The non competitive estimate, The competitive estimate Typical estimate 2.3 Establishing labour times- flat rate time, open time, estimated time, straight time (clock time) 2.4 Establishing cost of parts manufacturer catalogue, service life, service items 2.5 Establishing material cost materials involved, market price, mode of costing – unit or month wise 	

- 2.6 Repair versus replacement policy based on – workshop management, customers preference, parts availability, Specialise skill of the workers, Requirement for alignment of adjacent parts, partial panel replacement, Sectioning panels
- 2.7 Reference manuals – need and usage, The parts book , Parts names, Parts illustrations, The workshop manual
- 2.8 Methods of recording –forms details of owner, insurance information other information, main entries Summaries, materials , Sublet items
- 2.9 Assessment technique- Sequence inspection by grouping measuring devices and their use

3.0 REPAIRS PROCEDURES & TECHNIQUES 7

- 3.1 Straightening sheet metal
- 3.2 Stages of repair- Roughing out, Straightening, metal finishing
- 3.3 Typical damages- wing damage, door damage, rear end damage
- 3.4 Panel replacement – methods of panel removal, procedure
- 3.5 Use of body frame jigs – portable body frame machinery, fixed vertical support type – basic set-ups (Pull & anchor, pull hold down and anchor) Permanently anchored jigs
- 3.6 Engine damages- partial & full damage, brief repairing procedure and comparison with normal breakdown
- 3.7 Transmission parts damages – brief repair procedure and comparison with normal breakdown
- 3.8 Electrical damages- need of cable replacement

4.0 INSURANCE I 3

Definitions & suitable examples of following insurance terms

- 4.1 Good faith
- 4.2 Insurable interest
- 4.3 Indemnity
- 4.4 Subrogation
- 4.5 Contribution
- 4.6 Proximate cause

5.0 INSURANCE II 5

- 5.1 Introduction to motor insurance – need & classification
- 5.2 Comprehensive (Meaning, types, various provisions, conditions, premium calculation, bonus, risk cover)
- 5.3 Third party only
- 5.4 Third party, fire & theft
- 5.5 “Act” liability only
- 5.6 Comparison of above insurance policies on following parameters – Risk cover, other provisions, conditions, premium & application of vehicle
- 5.7 Insurance of Government vehicle, State transport undertaking (STU) general motor comparison with insurance policies

6.0 INSURANCE III 8

- 6.1 Proposal forms – bio-data of pro-poser, previous convictions, garage ownership & registration, cover required, insurance history, no claim discount, claims experience, declaration
- 6.2 Policy forms – Recital clause, operative clause, avoidance of certain terms & right of recovery, emergency treatment, no claim discount schedule, signature clause, conditions, notification, control of claim & subrogation,

cancellation, contribution, maintenance & examination, arbitration, observance of condition

- 6.3 Cover notes & certificates
- 6.4 Underwriting – Need & definition, various aspects of under writing vig. Acceptance of proposal, complete declinature, Motor vehicle act Cover only, Third party cover only, Third party fire/theft cover, compulsory excess, increased premium, exclusion of passenger cover, exclusion of personal accident benefits (private car policy), More than one factor involved, consideration at renewal & other points
- 6.5 Renewal procedure – need & definition & suitable examples
- 6.6 Moral Hazard – Age, acceptance, meaning & examples
- 6.7 Physical Hazard – The driver, Age & physical conditions, driving history, vehicle – power, capacity, weight, age, maintenance, design, load used, district garage, forfeiture of custom duty (Meaning & examples)

7.0 INSURANCE ORGANIZATIONS 5

- 7.1 Insurance Regulatory Authority of India (IRAI) Role, organization structure & its Jurisdiction
- 7.2 State level organization structure
- 7.3 Various motor vehicle insurance organizations in India. (Brief comparison)
- 7.4 Tribunals – Hierarchy of vehicle
- 7.5 Insurance Surveyor – license, jobs functions, opportunity of career mobility, work ethics

SUGGESTED LIST OF EXPERIMENTS/ FIELD OR SITE VISITS 30

1. Visit to denting & painting workshop.
2. Observe and study of proposal forms, policies forms, method of rating, premium computation etc. for following types of vehicles.
 - Private car
 - Commercial vehicle
 - Vehicle trade risk
 - Motorcycle.
3. Observe and follow process & policies of insurance by at least two companies
4. Prepare a survey report of at least two accidental vehicles from s.no.2

REFERENCE BOOKS/ JOURNALS

1. John Kendrick and Robert Macpherson *Crash Assessment and Repairs* Mc Grow Hills Book Company (UK) Ltd., London
2. The Chartered Insurance Institute Tuition Service *Auto Insurance*
3. Bill Tobolt *Auto body repairing and repairing* The Good Heart- Willcox Co. Inc, Home wood, Illinois
4. Verma and Agarwal *Insurance* Forward Book Depot Nai Sarak, Delhi
5. *Elements of General Insurance* LIC Publications
6. *Overdrive Journal* published by Tata Infomedia ltd, Mumbai
7. *Automotive engineering Journal* published by Society Of Automotive Engineering, (SAE)
8. *Insurance Times* published by The institute of insurance surveyors and adjusters 25, Baranashi Ghosh Street, Calcutta, India.

RETROFITTING IN MOTOR VEHICLE

L T P
3 0 2

Curri. Ref. No. AE 602

Total Contact hrs.: 75

Total marks: 150

Theory:

Theory: 45

End Term Exam: 75

Practical : 30

P.A.: 25

Credit: 5

Practical:

End Term Exam: 25

P.A.: 25

RATIONALE:

With unprecedented changes in Auto sector, today's Vehicle purchased is not satisfying prevailing situations in future because of changes in mindsets of user, particularly, in the context of safety, security & comfort. Some owners are going for change of vehicle while most others are going for retrofitting of market gadgets available. Moreover recent policy of government regarding fuels is attracting owners of vehicle to fit conversion kits.

In such circumstances, sub sector in auto, related to retrofitting is expected to emerge in near future. Manpower, requisite Knowledge, Skills, and Attitudes is, therefore, required and going to be vital.

UNIT TOPIC / SUB-TOPIC	Periods
1.0 RETROFITTING	5
1.1 Introduction & need of retrofitting	
1.2 Examples of retrofitting	
1.3 Technical feasibility of retrofitting	
1.4 Economic feasibility of retrofitting	
1.5 Difference between retrofitted & original system	
2.0 BODY RETROFITTING	6
2.1 Need, legal aspects & technical aspects (affecting vehicle performance)	
2.2 Conversion of normal vehicle to bullet-proof	
2.3 Conversions for comfort	
• Upholstery	
• Other amenities	
• Entertainment provision	
• Communication system.	
• Vision facilitation.	
• Provision to accommodate more goods/passenger	
3.0 ENGINE RETROFITTING	5
3.1 Conversion from petrol to diesel engine. Need, legal aspects, technical aspects (Effect on vehicle performance)	
3.2 Changes in foundation	
3.3 Other connections & peripherals	
4.0 CONVERSION FROM PETROL TO LPG	8
4.1 Need, legal aspects, comparison of LPG with petrol	

- 4.2 Various parts of LPG conversion kit. i.e. Vaporizer (types, function, construction & working)
 - Mixer (function, construction & working)
 - Solenoid valve (function, construction & working)
 - Safety valve (function, construction & working)
 - Cylinder (safety requirements, mounting, construction, various values etc)
 - Change over switch
 - Hoses & piping, fuel line, lambda probe, safety belt
- 4.3 Installation of LPG kit (procedure, safety precautions etc)
- 4.4 Maintenance of LPG system

5.0 CNG CONVERSION

8

- 5.1 Need, legal aspects, comparison with LPG & other fuels
- 5.2 Parts of petrol to CNG conversion kit
- 5.3 Parts of Diesel to CNG conversion kit
- 5.4 Various parts of CNG conversion kit
 - i.e. Vaporizer (types, function, construction & working)
 - Mixer (function, construction & working)
 - Solenoid valve (function, construction & working)
 - Safety valve (function, construction & working)
 - Cylinder (safety requirements, mounting, construction, various values etc)
 - Change over switch
 - Hoses & piping, fuel line, lambda probe, safety belt.
- 5.5 Installation of CNG kit (procedure, safety precautions etc)
- 5.6 Maintenance of CNG system

6.0 AC & VENTILATION SYSTEM FITTING

5

- 6.1 Need, legal aspect, technical consideration
- 6.2 Components of A/C system
- 6.3 Modification required for fitting A/C system.
- 6.4 A/C fitting procedure
- 6.5 Testing of the A/C system

7.0 ACCESSORIES

8

- 7.1 Guards – front, side, rear (need, drawbacks, fitting procedure)
- 7.2 Light guards (need, drawbacks, fitting procedure)
- 7.3 Luggage carrier (need, drawbacks, fitting procedure)
- 7.4 Wheel Disc cover (need, drawbacks, fitting procedure)
- 7.5 Sun control film (need, drawbacks, fitting procedure)
- 7.6 Rear & front spoilers (need & fitting procedure)
- 7.7 Music system (need & fitting procedure)
- 7.8 Power window (need, drawbacks of using these accessories, fitting procedure)
- 7.9 Retrofitting for double control for driving training
- 7.10 Trailer fitting.
- 7.11 Power steering (Need, technical requirements, Retrofitting procedure)
- 7.12 Steering column gear shifting to floor shifting.
- 7.13 Electric voltage enhancement
- 7.14 Dynamo to Alternator
- 7.15 Remote key less door lock
- 7.16 Alloy wheels
- 7.17 Catalytic convertor

Suggested List of Experiments / Demonstrations/ Field or Site Visits

Practical work on Retrofitting of Engine

1. Visit to various garages where retrofitting of Engine is carried out
2. Accessories fitting.
3. Visit to RTO office to study provision of retrofitting

Practical work on LPG

1. Preparing work for LPG installation – Engine condition check.
2. LPG installation for 2 wheels & 4 wheelers
3. After fitment test – Exhaust test
4. LPG cylinder charging - safety precautions etc.
5. Economics of LPG conversion.

Practical work on CNG

1. Preparing work for CNG installation – Engine condition check.
2. CNG installation for 2 wheels & 4 wheelers
3. After fitment test – Exhaust test
4. CNG cylinder charging - safety precautions etc.
5. Economics of CNG conversion.

Others

1. Visit to upholstery shop to observe latest processes
2. Visit to Air conditioning workshop to study fitment of AC & improvements in Vehicle Body
3. Visit to local shops to find varieties & makes of alloy wheels
4. Visit to local shops to find technical specification of -
Remote / key less door- lock
Power window
Music system etc.

REFERENCE BOOKS/MANUALS

1. Kirpal Singh *Automotive Engineering Vol I* Standard publishers and distributors, New Delhi
2. Crouse & Angline *Automotive Mechanics* McGraw Hills International Publication
3. Service manuals of various two wheelers and four wheeler manufacturers.
4. Mathur & Sharma *Internal Combustion Engine* Dhanpat Rai & Sons, New Delhi
5. Don Knowles *Auto Mechanics- Understanding new technology* Reston Publishers, New Jersey
6. Bosch/ SAE (distributor) *Automotive Handbook*

Others

1. Transparencies
2. Charts LPG, CNG fuel systems
3. Models
4. Various kits for retrofiting

TYRE MAINTENANCE & RETREADING

L T P
3 0 2

Curri. Ref. No. AE 603

Total Contact hrs.: 75

Total marks: 150

Theory:

Theory: 45

End Term Exam: 75

Practical : 30

P.A.: 25

Credit: 5

Practical:

End Term Exam: 25

P.A.: 25

RATIONALE:

Tyres are required to carry the load of the vehicle at desired speeds, transfer braking efforts and withstand the thrust at varying road conditions. Thus the life of tyres are always affected by many factors, such as driving habits, loads, speeds, tyre pressure, road conditions, wheel alignment, vehicle condition, etc. On the other side, the prices of tyres are also a major investment in any automobile. Short life and tyre failures affect the life of vehicle as well as the life of passengers. Thus, as automobile person, one should have the necessary knowledge of tyre maintenance and retreading process.

UNIT TOPIC / SUB-TOPIC	Periods
1.0 INTRODUCTION	5
1.1 Role of Automobile Engineer in tyre sales & service field	
1.2 Desirable properties & considerations in tyre design	
1.3 Tyre manufacturing process in brief	
1.4 Tyre specifications & selection of tyres- section width, nominal aspect ratio, construction, rim diameter, load index, speed symbol etc	
1.5 Tyre material (Material for various constituents of tyre, popular materials & material for special applications)	
2.0 CLASSIFICATION OF TYRES	4
2.1 Conventional tubes, tubeless tyres & solid rubber tyre (Construction, comparison & application)	
2.2 Cross ply, radial ply & belted bias (Construction, comparison, limitations & application)	
2.3 Special application tyres viz. acquagel, dinovo, tractor, earthmoving machine and tyre for military applications (special features, construction, application & comparison with conventional tyres)	
2.4 Tread patterns (various tread patterns, their significance, comparison & applications)	
3.0 TYRE ECONOMICS	4
3.1 Prices of tyres for various applications in India, fluctuation in prices compared to other auto spares	
3.2 Running cost of tyre calculated on manufacturer's specified life of tyre, cost of tyre per km. & its contribution in overall vehicle running cost. Role of tyre maintenance in fuel efficiency	
3.3 Warranty/guaranty – (terms & conditions. Tyre claim settlement)	
3.4 Tyre mileage recording system (Importance & information system)	
3.5 Economics of tyre re-treading	

4.0 TYRE MAINTENANCE

6

- 4.1 Importance in the context of vehicle control & vehicle performance
- 4.2 Scheduled maintenance
(Criteria for deciding schedule of tyre maintenance for different applications)
- 4.3 Factors in scheduled maintenance
 - Wheel balancing
 - Wheel alignment
 - Tyre rotation
 - Switching & matching
 - Daily maintenance such as foreign bodies removing, inflation, twin tyre damage, visual inspection etc
- 4.5 Miscellaneous aspects in tyre maintenance/use
 - Tyre deterioration – aging, storage precaution for off road vehicle, effect of oil, fuel & other chemicals on tyre
- 4.6 Decision for discarding or sending tyre for re-treading
- 4.7 Machine, equipments & tools required for
 - Tyre maintenance
 - Tyre changing & fitting machine
 - Tyre removal tools
 - Inflation garage with its calibration

5.0 TYRE DEFECTS & REPAIRS

8

- 5.1 Different wear patterns
 - Center wear – feathered edge on tread
 - One side wear – outer, inner
 - Diagonal wear – sharp edge on sides
 - Hill & toe wear
 - Localized spot wear
 - (Identification & extent of type of wear, cause, remedies in vehicle & about tyre)
- 5.2 Other defects in tyre
 - Wheel wobble & cornering noise
 - Ply separation
 - Tread cracking & separation
 - Foreign bodies in tyre
 - Tread chipping
 - Improper use of tools for removing & fitting of tyre
 - Side wall scuffing
 - (Identification & extent of type of wear, cause, remedies in vehicle & about type)
- 5.3 Tyre injuries & repair
 - Nail hole repair
 - Spot repair
 - Reinforcement repair
 - Sectional repair

6.0 TYRE RETREADING

10

- 6.1 What is retreading
- 6.2 Suitability of tyre for retreading
- 6.3 Types of retreading
 - Hot retreading (Tyre condition for hot retreading & comparison with cold)

- Cold retreading (Tyre condition for cold retreading & comparison with hot retreading)
- 6.4 Hot Retreading Process
- Inspection
 - Buffing
 - Cleaning (Brushing)
 - Application of cushion gum
 - Processing in tyre retreading machine
 - Inspection
- 6.5 Cold Retreading Process
- Failures in hot retreading process
 - Inspection
 - Buffing
 - Cleaning
 - Application of bounding gun
 - Preview of tread rubber
 - Bounding
 - Final Inspection
 - Retreading failure

7.0 PLANT & EQUIPMENT FOR TYRE RETREADING

8

7.1 General layout of tyre retreading plant

7.2 Machine & equipments

- Boiler
- Hot retreading machine chamber
- Cold retreading machine boulder
- Buffing machine
- Pressing dies

(Construction, working, maintenance, capital cost and running cost)

7.3 Tools & gauges for retreading

(Types of tools & gauges, their use & specifications)

7.4 Consumables

Direct & indirect consumables required for hot & cold retreading process

SUGGESTED LIST OF LAB EXPERIMENTS/DEMONSTRATIONS/ FIELD OR SITE VISITS

30

1. Visit to hot retreading tyre plants
2. Visit to cold retreading tyre plants
3. Visit to local fleet operator to observe and write down various tyre failures
4. Carry out wheel balancing of wheels
5. Carry out wheel alignment of at least four kinds of vehicles
6. Compare constructional and working features of prevalent wheel balance & alignment machines
7. Compare constructional features and application of tube, tubeless and solid rubber tyres
8. Compare constructional features and application of crossply, radial and belted bias tyres
9. Identify machines and equipment for tyre retreading and repair their technical specifications
10. Use and draw a neat diagram of different tools and gauges for tyre retreading
11. Identify and use various machines/equipment and tools required for –

- Tyre maintenance
 - Tyre removal
 - Tyre changing
12. Service and repair of different types of tyres
 13. Prepare a project report for
 - (i) Setting up hot & cold retreading plant – it should include ‘Economics’, Machine/equipment specification, layout & marketing
 - (ii) Analyse typical faults in tyres – Any twelve

REFERENCE BOOKS / JOURNALS / MANUALS

1. Dr. Kirpal Singh *Automobile Engineerig- Vol. I 7th Edition* Standard Pulishers Distributors, Delhi
2. Crouse & Angeline *Automotive Mechanics 10th edition* McGraw Hills International Publication
3. Bosch/ SAE (distributor) *Automotive Handbook, 4th Editon*
4. Don Knowles *Auto Mechanics- Understanding new technology* Reston Publishers, New Jersey
5. *Service manuals of various tyre manufacturers*
6. *Service manuals of various original equipment pertaining to tyre*
7. ‘Overdrive’ Journal published by Tata Infomedia Ltd. Mumbai.
8. ‘Automotive Engineering’ Journal published by Society of automotive Engineering (SAE)

AGRICULTURE AND EARTH MOVING MACHINERY

L T P
3 0 2

Curri. Ref. No. AE 604

Total Contact hrs.: 75

Total marks: 150

Theory:

Theory: 45

End Term Exam: 75

Practical : 30

P.A.: 25

Credit: 5

Practical:

End Term Exam: 25

P.A.: 25

RATIONALE:

Worldwide automobiles are not only used for movement of people or for transportation of materials, but also for other areas also, such as- construction, mining, agriculture, etc. As an automobile supervisor, one should have the knowledge of the various kinds of auto-equipment, their systems, uses, etc., which will help him proper operation and maintenance.

UNIT TOPIC / SUB-TOPIC	Periods
1.0 EARTH MOVING MACHINES – INTRODUCTION	07
1.1 Comparison between general automobile & earth moving machine on following parameters	
• Travelling Speed	
• Working conditions	
• Power output & power variations	
• Torque & torque variations.	
• Steering	
• Suspension	
• Fuel & fuel consumption	
• Hydraulics	
• Power take offs	
• Clutch	
• Driving licence	
• RTO registration	
• Brakes	
1.2 Layout & Classification- Layout & specification of earth moving machines (Dozer Excavator) (Power train, PTO, buckets, boom, arm etc.)	
2.0 TRACTOR DOZER	10
2.1 Types	
2.2 Block diagram (Power train, buckets swing & layout)	
2.3 Applications (Ripping, Blasting Vs Ripping, Types of ripper hinge & parallelogram, application & comparison. Ripper tip selection, Dozing, Underwater application	
2.4 Capacities – Dozing & Ripping	
2.5 Dozer blade – Straight dozer, Angle dozer, hydraulic control & cable control, 'S' blade,	
2.6 'U' blade, 'C' blade, 'A' blade, and their applications.	
2.7 Track shoe (construction)	

2.8	Under carriage maintenance – (Track shoes, track rollers, shoes, bushings, sprockets etc.	
2.9	Precautions for Dozer operations	
3.0	DRAGLINE – ROPE OPERATED EXCAVATOR	4
3.1	Uses of dragline e.g. Excavating channels, Ditches, trenches, underwater soil, stripping overburden, shallow grading, general excavation, loading into hoppers, loading hauling units, sloping & grading.(Only simple sketch)	
3.2	Additional attachments of dragline- Clamshell – application, capacity, bucket, construction & size, Hoes – Application, Cranes – Application	
4.0	LOADER AND EXCAVATORS	6
4.1	Crawler loader – Block diagram, standard bucket, bulk handling bucket, fork loft attachment, crane attachment, stability & safety of crawler loader	
4.2	Wheeled loader – Block diagram, stability & safety, capacity & output.	
4.3	Wheeled loader/back hoe – Block diagram, stability & safety, capacity & output	
4.4	Hydraulic Excavator: Application, block diagram, types of buckets for different applications, stability & safety, capacity & output e.g. 3 in 1 bucket, ejector bucket, square hole bucket, ditch digging bucket, clay bucket, hydraulic grab. (Figure, application & capacity)	
4.5	Scraper: Block diagram, types – Towed & self-propeller, stability & safety, capacity & outputs	
4.6	Motor Grader – Block diagram, constructions, application, stability & safety, capacity & outputs	
5.0	TRACTOR	8
5.1	Compare tractor & automobile (Various components from engine to tyres)	
5.2	Indian tractor industry (Total turnover, Production per year, position of India in World tractor market, future)	
5.3	Layout of a tractor	
5.4	Power train & transmission layout of a tractor	
5.5	Tractor tyres (selection & speciality)	
5.6	Counterweight & its importance	
5.7	Power take off	
5.8	Types implements in tractors, its uses & its effect on performance of a tractor	
5.9	Power tiller - Compare with tractors, Technical & economic, Market in India, Various attachments & its use	
6.0	HYDRAULICS IN TRACTORS AND EARTH MOVING EQUIPMENT	10
6.1	Properties of hydraulic fluid	
6.2	General hydraulic circuit	
6.3	Main components of hydraulic general system viz. Hydraulic oil, hydraulic tank or reservoir, hydraulic pump, main relief valve, valve block, actuators, filters, strainers, hoses, control valves, seals & gaskets (function, general construction, location)	
6.4	Pumps – Classification, positive, non positive, vane pump, gear pump, piston pump, single pumps, double pumps, fixed delivery, variable delivery. (Compare, application, sketch, working & construction)	

- 6.5 Hydraulic motors comparison with pump, and classification.
- 6.6 Valves: Use & function
- 6.7 Classification – (Pressure control, flow control & Distribution control)
- 6.8 Pressure control – Relief, unloading, check valve.
- 6.9 Relief valve – Main relief, Auxiliary relief valve (Construction, working, application, compare)
- 6.10 Flow control valves – Non-compensating & compensating type. (Construction, working, application, compare)
- 6.11 Directional control valve – Classification (working, construction & application of any two types)
- 6.12 Pressure switches – (Application, working & construction)
- 6.13 Pressure sequence valve – (Application, working & construction)
- 6.14 Tractor PTO hydraulic circuits (Simplified circuit & components)

SUGGESTED LIST OF LAB EXPERIMENTS/DEMONSTRATIONS/ FIELD OR SITE VISITS

30

1. Visit to an earth moving repair centre
2. Visit to a mine or construction site where earth moving equipment are in operation.
3. Dismantle & assembly of Tractor and observe fitment of various parts
4. Visit to tractor manufacturing unit
5. Assembly and dismantling of various hydraulic circuits in tractor and earth moving machinery
6. Perform various experiments on hydraulic tutorial kit.
7. Compare constructional features & specification of different units in a crawler/wheel type dozer
8. Compare constructional features & specification of different units in a loader or shovel
9. Observe and prepare schedule maintenance of at least three kinds of HEM machines
10. Overhauling of engine, transmission, breaks and steering system of at least one equipment
11. Observe auto electrical system of heavy earth moving equipment and Identify various components, Draw circuit diagram, Function of components
12. Observe fuel pumps calibration, write down the procedure for the same
13. Follow engine tuning process for tuning of engine

REFERENCE BOOKS / JOURNALS / MANUALS

1. Jagman Singh *Art of earth moving* Oxford and IBH publishing company, New Delhi
2. Radichev V. *Tractors and automobile* Mir publisher, Moscow
3. Burger *Tractors and their power units* Willey Eastern Pvt. Ltd, New Delhi
4. Tucker V. V. *Earth moving plant* Goodhead- Foulkner ltd. Great Britain
5. *Service manuals of various relevant manufacturers*
6. *Service manuals of various original equipment manufacturer for Earth moving plants*
7. 'Overdrive' Journal published by Tata Infomedia Ltd. Mumbai.
8. 'Automotive Engineering' Journal published by Society of automotive Engineering (SAE)

TWO WHEELER PRODUCTION & MAINTENANCE

L T P
3 0 2

Curri. Ref. No. AE 605

Total Contact hrs.: 75

Total marks: 150

Theory:

Theory: 45

End Term Exam: 75

Practical : 30

P.A.: 25

Credit: 5

Practical:

End Term Exam: 25

P.A.: 25

RATIONALE:

India is a largest producer & consumer of two-wheelers in the World. Further there is extensive advancement in two-wheeler sector in terms of technological & service aspects. Automobile engineer is supposed to work in certain sections of two-wheeler producing factory & mostly in sales & service of two-wheelers. He must be thorough with various aspects about production & service two-wheelers.

UNIT TOPIC / SUB-TOPIC	Periods
1.0 TWO WHEELER SCENARIO IN INDIA	4
1.1 Production & sales of two-wheelers in India & other countries (comparison based on statistics & future trend of two wheelers in India)	
1.2 Category wise production, sale & collaboration two-wheelers in India, their manufacturer, foreign and various relevant inferences about it	
1.3 Category wise sale in India. Density of two wheelers in various states/cities of India with respect to Nagaland State	
2.0 MANUFACTURING OF TWO WHEELERS	10
2.1 General layout of two-wheeler manufacturing plant (various shops, movement of components & sub-assemblies among shops)	
2.2 Various shops & departments, their role & interrelations, facilities for material handling i.e. forklift, trolley, cranes, conveyor etc.	
2.3 Final vehicle assembly shop - layout, equipment & tools, process, principle of line balancing.	
2.4 Engine assembly shop – layout, equipment & tools, process, selective, assembly-need, meaning & examples.	
2.5 Vehicle testing	
• On road test – in factory premises (max. speed, hands of stability, braking front & rear, & electrical	
• Long run test – Samples, procedure & parameters tested	
• Test bed testing – rpm, fuel efficiency	
2.6 Engine testing – Power, torque, knock, fuel efficiency, pollution testing	
2.7 Original equipment manufacturers of parts & sub-assemblies (brief introduction)	

3.0 TWO WHEELER CHASSIS	5
3.1 Layout of two-wheelers	
3.2 Power train and body	
3.3 Types of two-wheeler chassis	
3.4 Tabular, cradle type, sheet metal type, (general joining processes, presswork)	

4.0 TWO WHEELER ENGINES	6
4.1 Classification	
4.2 Two stroke – multi-port, reed valve, volvola, petrol oil, & separate oil tank lubrication	
4.3 Four-stroke – General construction & lubrication	
4.4 CNG & LPG fuels – changes in fuel system & engine construction	

5.0 TRANSMISSION	8
5.1 Gear transmission with manual clutch – layout, working, shifting mechanism, application	
5.2 Gear transmission with automatic clutch – Two stage & three stage (layout, working & application)	
5.3 Variomatic transmission with automatic clutch (layout, working, comparison & application)	
5.4 Final reduction – Chain drive, belt drive (Examples & Comparison)	
5.5 Wheels & tyres – various types – wire & disc wheels, specification of tyres	

6.0 CONTROLLING SYSTEM	7
6.1 Steering – construction, nomenclature, handle bar	
6.2 Brakes – drum & disc brake, Automotive mechanism, mechanical cable & link & hydraulic (construction, working & setting)	
6.3 Brake Setting	
6.4 Suspension system – Telescopic (coil – hydraulic) anti-dive system	

7.0 COMPANY AFTER SALES SERVICE	5
7.1 Organization of service department	
7.2 Work profile of service engineer – receiving vehicle, pre-delivery inspection, warranty, and claims – feedback and certification, quality assurance in the context of service policy being tangent of by company training campus	

SUGGESTED LIST OF LAB EXPERIMENTS/DEMONSTRATIONS/ FIELD OR SITE VISITS **30**

1. Overhaul Engine and transmission system of a scooter and a motorcycle.
2. Identify and draw an electrical wiring of two-wheelers such as scooter and motorcycle
3. Bodywork, denting and painting of two-wheeler.
4. Overhaul Suspension and brake system of two-wheeler.
5. Observe and note down two wheeler-manufacturing activities in auto industry
6. Visit to two wheeler auto service stations
7. Servicing of any two-wheelers. One each from scooter and motorcycle category

REFERENCE BOOKS /MANUALS/JOURNALS

1. Dr. Kirpal Singh *Automobile Engineerig- Vol. I 7th Edition* Standard Pulishers Distributors, Delhi
2. Sebastian Kelly *Year book of A to Z motorcycles* Anness Publishing Ltd. Hongkong
3. Bosch/ SAE (distributor) *Automotive Handbook, 4th Editoon*
4. Crouse & Angline *Automotive Mechanics ,10th Edition*, McGraw Hills International Publication
5. *Service manuals of various two wheeler manufacturers*
6. *Service manuals of various original equipment pertain to two wheelers*
7. `Overdrive` Journal published by Tata Infomedia Ltd. Mumbai.
8. `Automotive Engineering` Journal published by Society of automotive Engineering (SAE)

SAMPLE PATH

SAMPLE PATH- TERM - I: Automobile Engineering

Sl. No	Code	Course	Study Scheme				Evaluation Scheme						Total Marks	Credit
			Pre-requisite	Contact Hour/Week			Theory			Practical				
				L	T	P	End Exam	Progressive Assessment		End Exam	Progressive Assessment			
				Class Test	Assignment			Sessio nal	Viva					
1	G101	Communication Skill-I		3	0	0	75	10	15	0	0	0	100	3
2	G103	Mathematics-1		3	1	0	75	10	15	0	0	0	100	4
3	G105	Physics-I		3	0	2	75	10	15	25	25	0	150	4
4	G107	Chemistry-I		3	0	2	75	10	15	25	25	0	150	4
5	G109	NSS1/NCC1		0	0	2	0	0	0	25	25	0	50	1
6	G201	Engineering Drawing -I		1	0	3	50	0	0	0	50	0	100	3
7	G203	Workshop Practice-I		1	0	3	0	0	0	50	50	0	100	3
8	G206A	Introduction to Computer Programming		2	1	2	50	0	0	25	25	0	100	4
TOTAL				16	2	14	400	40	60	150	200	0	850	26

SAMPLE PATH- TERM - II: Automobile Engineering

Sl. No	Code	Course	Study Scheme				Evaluation Scheme						Total Marks	Credit
			Pre-requisite	Contact Hour/Week			Theory			Practical				
				L	T	P	End Exam	Progressive Assessment		End Exam	Progressive Assessment			
				Class Test	Assignment			Sessio nal	Viva					
1	G102	Communication Skill -II	G101	2	1	2	50	0	0	25	25	0	100	4
2	G104	Mathematics II		3	1	0	75	10	15	0	0	0	100	4
3	G106	Physics II	G105	3	0	2	75	10	15	25	25	0	150	4
4	G108	Chemistry II	G107	3	0	2	75	10	15	25	25	0	150	4
5	G110	NSS2/NCC2		0	0	2	0	0	0	25	25	0	50	1
6	G202	Engineering Drawing II	G201	1	0	3	50	0	0	0	50	0	100	3
7	G204	Workshop Practice II	G203	1	0	3	0	0	0	50	50	0	100	3
8	G205	Engineering Mechanics		3	0	0	75	10	15	0	0	0	100	3
TOTAL				16	2	14	400	40	60	150	200	0	850	26

SAMPLE PATH- TERM - III: Automobile Engineering

Sl. No	Code	Course	Study Scheme				Evaluation Scheme						Total Marks	Credit
			Pre-requisite	Contact Hour/Week			Theory			Practical				
				L	T	P	End Exam	Progressive Assessment		End Exam	Progressive Assessment			
				Class Test	Assignment			Sessio nal	Viva					
1	G301	Environmental Education		3	0	0	75	10	15	0	0	0	100	3
2	AE401	Automobile Drawing		1	0	3	50	0	0	0	50	0	100	3
3	AE402	Manufacturing Processes		3	0	0	75	10	15	0	0	0	100	3
4	AE403	Strength of Materials and Machine Design		3	0	0	75	10	15	0	0	0	100	3
5	AE405	Heat Power Engineering		3	0	0	75	10	15	0	0	0	100	3
6	AE406	Fluid Mechanics and Machines		3	1	2	75	10	15	25	25	0	150	5
7	AE410	Workshop Practice -III		0	1	4	0	0	0	50	50	0	100	3
8	G207	Fundamentals of Electrical & Electronics Engineering		3	0	2	75	10	15	25	25	0	150	4
TOTAL				23	2	11	490	60	90	100	150	0	900	27

SAMPLE PATH- TERM - IV: Automobile Engineering

Sl. No	Code	Course	Study Scheme				Evaluation Scheme						Total Marks	Credit
			Pre-requisite	Contact Hour/Week			Theory			Practical				
				L	T	P	End Exam	Progressive Assessment		End Exam	Progressive Assessment			
				Class Test	Assignment			Sessional	Viva					
1	G302 A-F	Softcore 2		3	0	0	75	10	15	0	0	0	100	3
2	AE408	Automobile Engine -I		3	1	2	75	10	15	25	25	0	150	5
3	AE411	Automobile Chassis		3	1	2	75	10	15	25	0	25	150	5
4	AE503	Transport Management and Motor Vehicle Act		3	0	0	75	10	15	0	0	0	100	3
5	AE504	Automobile Workshop		0	1	4	0	0	0	50	50	0	100	3
6	AE404	Theory of Machines		3	0	0	75	10	15	0	0	0	100	3
7	AE508	Auto Body Work Practices		3	1	2	75	10	15	25	25	0	150	5
TOTAL				18	4	10	450	60	90	125	100	25	850	27

SAMPLE PATH- TERM - V: Automobile Engineering

Sl. No	Code	Course	Study Scheme				Evaluation Scheme						Total Marks	Credit
			Pre-requisite	Contact Hour/Week			Theory			Practical				
				L	T	P	End Exam	Progressive Assessment		End Exam	Progressive Assessment			
								Class Test	Assignment		Sessio nal	Viva		
1	AE409	Automobile Engine - II	AE 408	3	1	2	75	10	15	25	25	0	150	5
2	AE407	Metrology and Quality Control		3	1	2	75	10	15	25	25	0	150	5
3	AE505	Automobile Power Train		3	1	2	75	10	15	25	25	0	150	5
4	AE 506	Automobile Electronics		3	1	2	75	10	15	25	25	0	150	5
5	AE510	Driving Practice		0	1	2	0	0	0	0	25	25	50	2
6	AE 502	Vehicle Maintenance and Garage Practice		2	1	4	50	0	0	25	25	0	100	5
TOTAL				14	6	14	350	40	60	125	150	25	750	27

SAMPLE PATH- TERM - VI: Automobile Engineering

Sl. No	Code	Course	Study Scheme				Evaluation Scheme						Total Marks	Credit
			Pre-requisite	Contact Hour/Week			Theory			Practical				
				L	T	P	End Exam	Progressive Assessment		End Exam	Progressive Assessment			
								Class Test	Assignment		Sessio nal	Viva		
1	AE509	Project		0	0	8	0	0	0	0	100	50	150	4
2	AE 501	Automotive Air Conditioning		2	1	4	50	0	0	25	25	0	100	5
3	AE507	Auto Engine Reconditioning		2	1	4	50	0	0	25	25	0	100	5
4	AE511	Technical Seminar		0	0	6	0	0	0	0	50	50	100	3
5	AE 512	Industrial Training (3 weeks OJT+1 week orientation)									100	100	200	10
6	AE601-605	Elective I		3	0	2	75	15	15	25	0	25	150	5
7	AE601-605	Elective II		3	0	2	75	15	15	25	0	25	150	5
TOTAL				16	0	21	350	75	75	100	300	250	950	37